AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

FEBRUARY, 1959

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Precision Metal Molding

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EXTRUSIONS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

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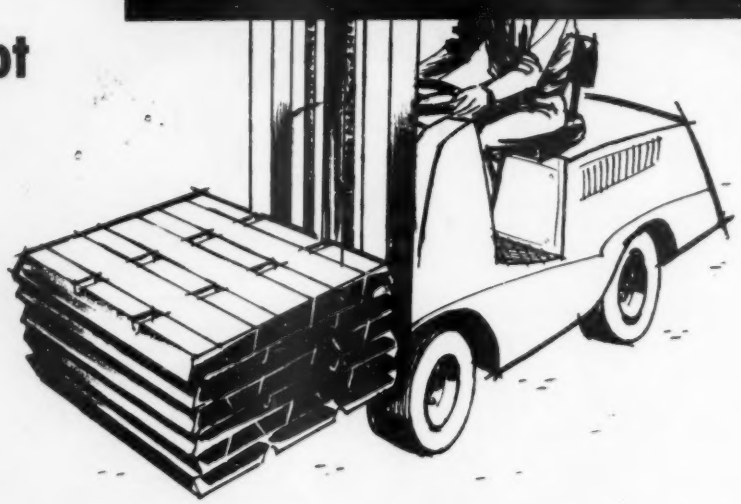

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IN THIS ISSUE

February, 1959: Volume 17 Number 2

COVER

BY INVESTMENT CASTING many knotty problems can be solved. The most favorable design, in the best material and at the lowest production cost are only a few of the possible gains. Shown on our cover are T. William Benedict, military contracts manager (formerly chief mechanical engineer); Lloyd E. Raymond, process engineer; and Kenneth J. Kay, manager of the hook and bobbin case department: all of Singer Mfg. Co. They're examining a thread take-up lever for industrial sewing machines.

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30 DIE CASTING UNDER REDUCED ATMOSPHERIC PRESSURE
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32 ELECTRON BEAM MELTING
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33 WHO USES EXTRUSIONS?
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38 WHY USE MAGNESIUM CASTINGS?
The much lower cost of machining and the lower shipping charges for magnesium castings make this little used metal especially attractive.

40 CUSTOM ATOMIZED METAL POWDERS
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44 PROPERTIES OF EXTRUDED ALLOYS — PMM TECHNICAL REFERENCE FILE
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Precision Metal Molding

PMM

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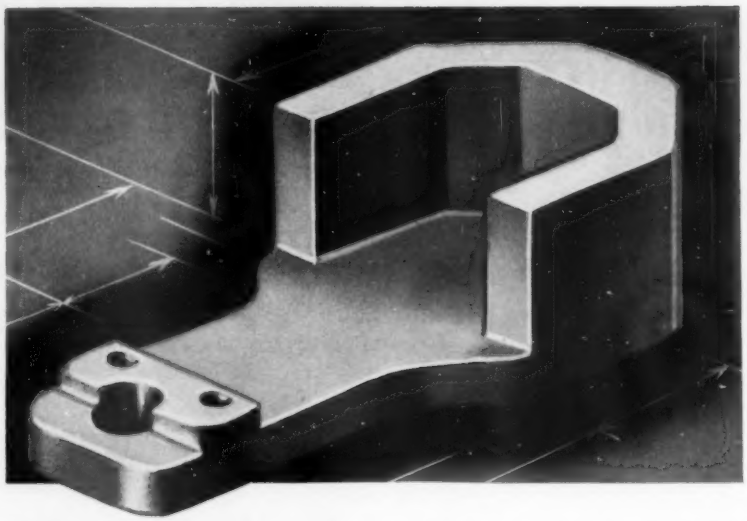

The photograph shows a bearing support plate for a new line of power tools manufactured and marketed by a large and very capable organization.

The complex nature of the part is apparent at a glance and the cost of machining such a part is evident to the eye of engineer and designer.

It is on parts of this nature that powder metallurgy offers its greatest advantages and its greatest opportunities for the future.

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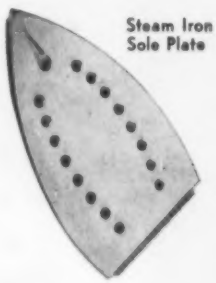

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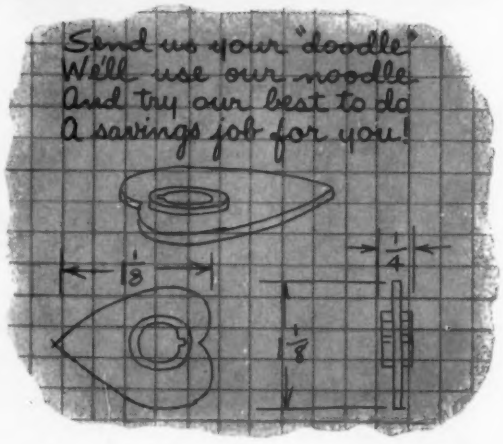
As a leading supplier of metal powders, Glidden works closely with parts producers. In this way, several staffs of experienced technicians may be at your disposal—to provide complete technical service and suggest possible design changes that may bring even lower parts costs.



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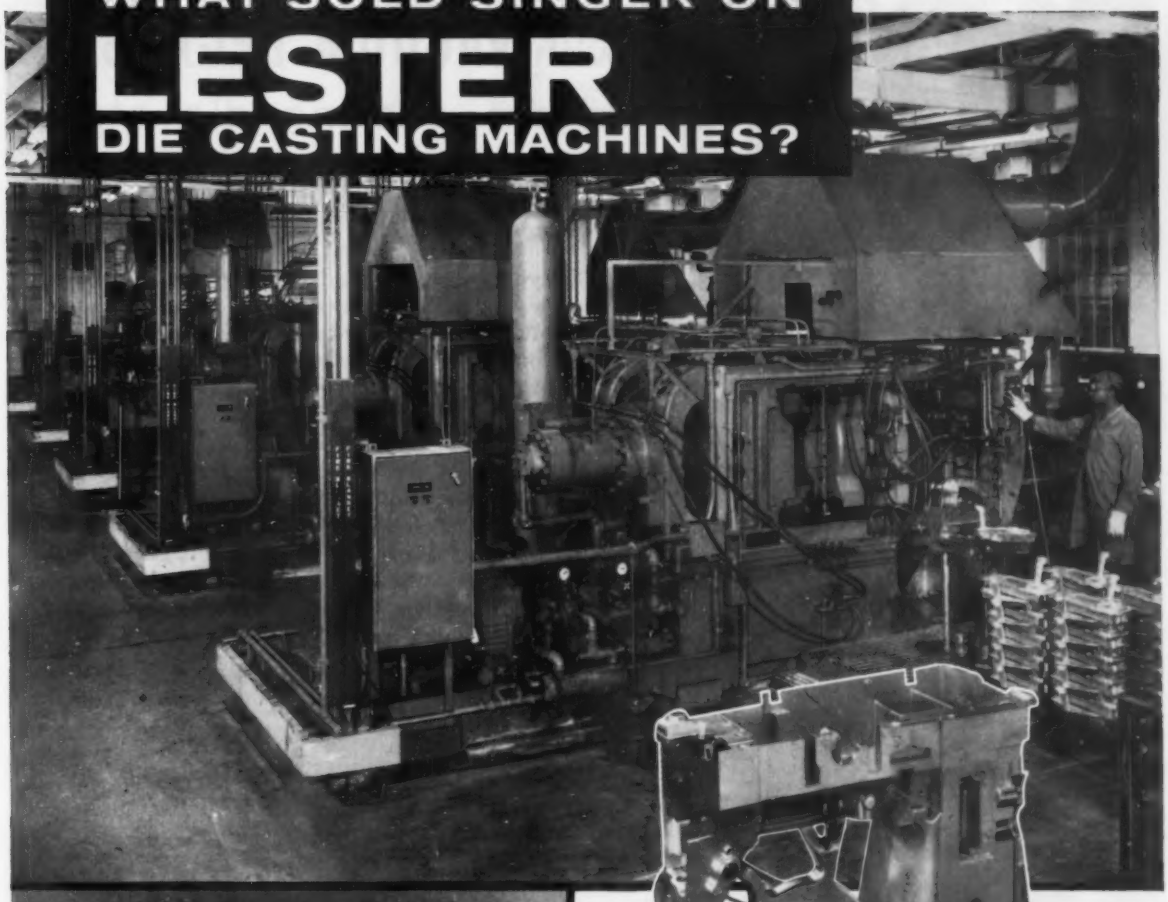
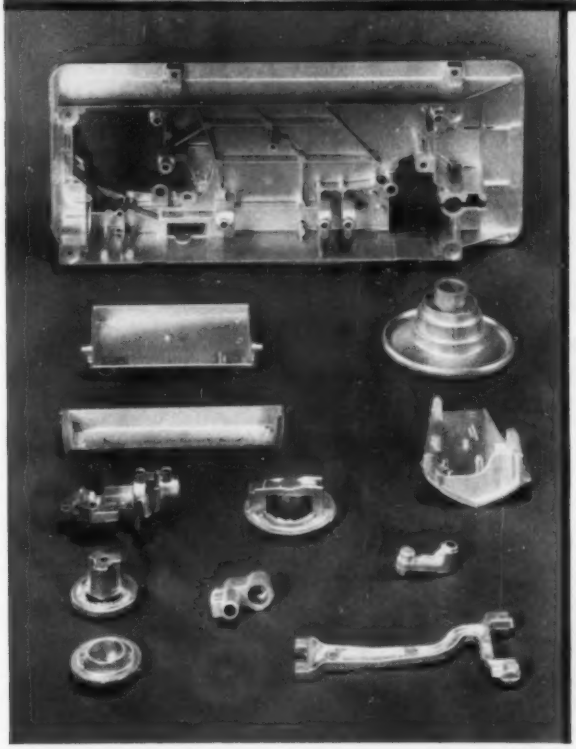
WHAT SOLD SINGER ON LESTER DIE CASTING MACHINES?





6¼ lb. aluminum arm unit, cast on 800 ton Lester at Singer. Other SINGER parts, all cast on Lesters, shown at left.

What sold SINGER on Lesters? The basic rigidity of the one-piece frame which can be depended upon to tightly lock and keep locked even the largest of their dies, the main arm unit for their new model #401 SLANT-O-MATIC Sewing Machine. With this dependable clamp, they obtain consistent production of quality castings, with finish and density they have been otherwise unable to obtain.

As a result, Singer has installed 15 Lester Die Casting Machines of 800 ton and 600 ton capacity in their plant in Elizabethport, New Jersey.

Detailed information on Lester Die Casting Machines is available by writing...

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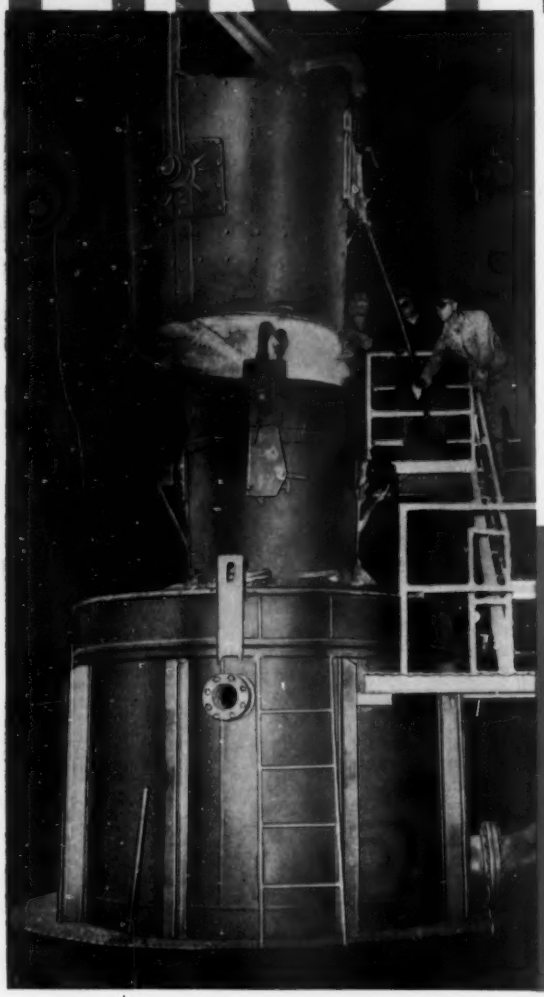

For your most exacting die casting jobs, Thermold AV gives you the assurance of highest quality by the use of the ultimate in melting technique—vacuum degassing.

Now large size ingots are vacuum degassed in standard production processing—the first tool steel degassing installation in the United States.

This new advantage is in addition to quality controls that have set the standard for the industry—small batch furnace melting, close control of press forging and annealing, and 100% Reflectoscope testing.

With this contribution to the high quality of Thermold AV, Universal-Cyclops gives further assurance of homogeneity of structure, freedom from gaseous impurities, high polishing quality and the utmost resistance to thermal and mechanical fatigue.

Write for new bulletin.

A heat of Thermold AV being processed in the vacuum degassing installation.

A block of Thermold AV measuring 18" x 26"x 43". One of the largest forged blocks of high alloy die casting die steel ever produced—typical of sizes available vacuum degassed.

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LETTERS

the readers' forum

CAST FINS

I am starting to manufacture water skis and am very interested in finding out who casts aluminum fins which screw or bolt onto the bottom of the skis. If you know of anyone who is casting this type of hardware, I would appreciate a return letter with their address. – R. A.

We do not know of any company who has stock dies for these parts. Generally every company who makes water skis has their own dies for the necessary hardware.

Possibly some of our readers have such castings for sale or know where they can be purchased. – ed.

PLASTER MOLDS

I would like to get any information regarding casting with plaster. I have need for casting Kirksite metal for molds and would like to know what type of plaster to use for the molds. – S. C.

Information on plaster mold casting, particularly the proper mold materials, can be secured from either U. S. Gypsum Co. or National Gypsum Co. – ed.

INFORMATION ON POWDER METALLURGY

We would like to subscribe to your trade magazine as we are planning to install a powder metal department. – F. S.

DIE CASTING DIRECTORY

Will you please send us a copy of your January issue containing the directory of contract die casting companies. – G. M. J.

We are always glad to furnish copies of this directory issue at the published prices as long as our supply lasts. Previous issues (1957 and 1958) sold out within a few weeks of publication. If any of our readers want extra copies they should order them early. – ed.

CAST DIE CAVITIES

We have read with interest your reprint of "Cast Die Cavities" by Irwin Lubalin and would like to receive a copy of it.

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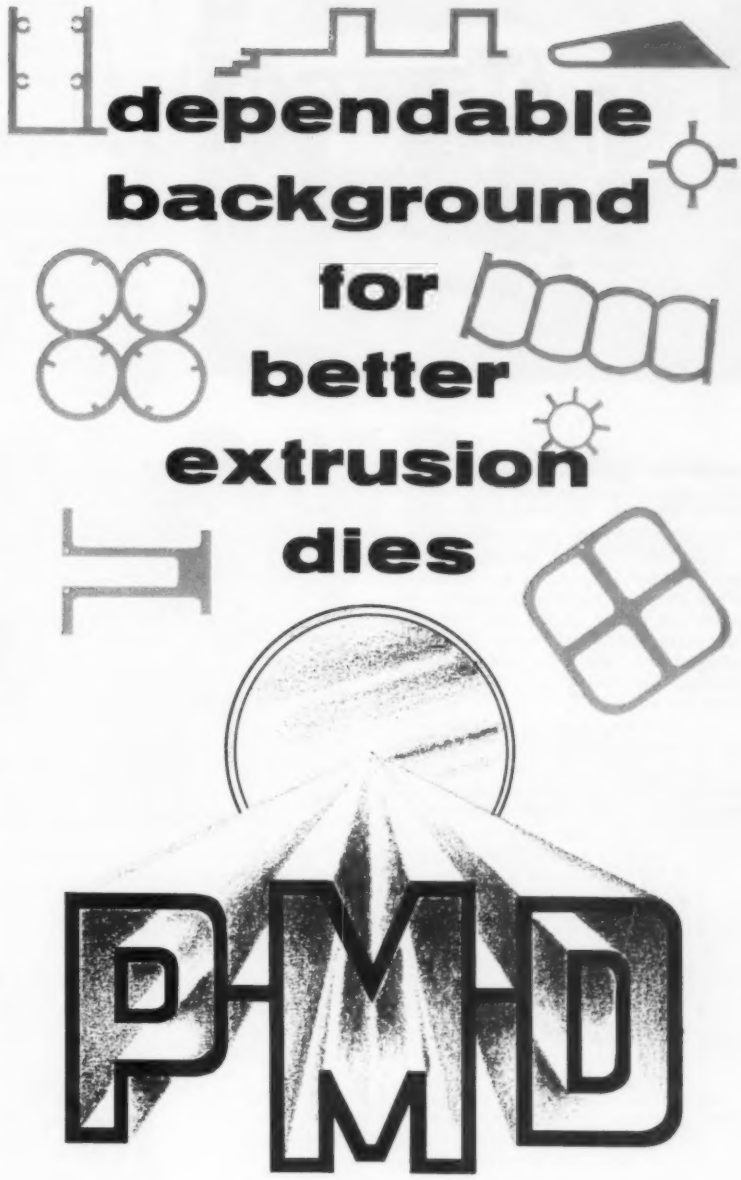

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PROMPT SERVICE—PMD is staffed and equipped to get your die to you when you need it.

CAST EXTRUSION DIES—are now available at PMD, for extruding brass, copper, steel alloys, and rare earth metals. Leading extruders agree that these cast dies have longer life and give them closer tolerances, better performance, lower tooling costs.

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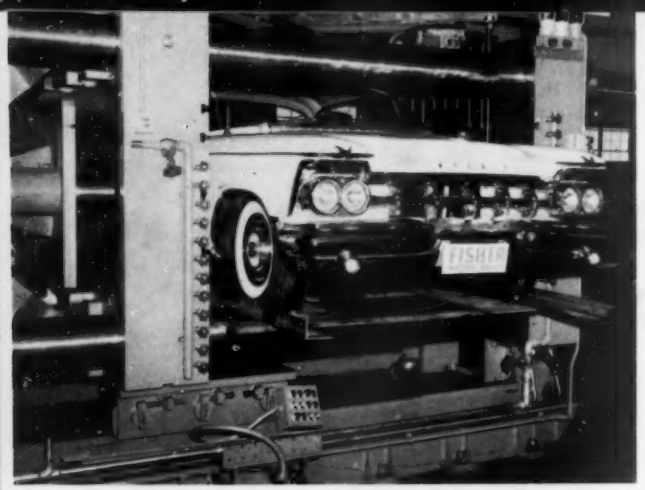


CASTING ABOUT

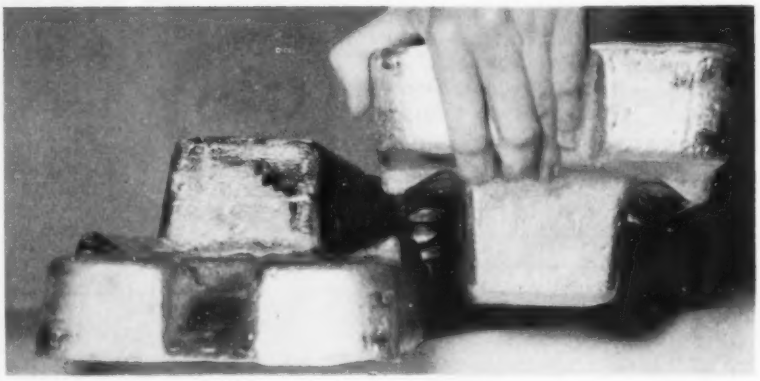
technical news of applications & processes involving precision metal moldings

NOT A DIE CAST CAR, but this new Cast-Master machine seems almost big enough to do the job. Rated at 2000 tons locking pressure (it will actually go considerably higher) the new monster will handle a 70 pound shot of aluminum. It's scheduled to go to Chrysler's Kokomo, Ind. installation. The castings to be made on the new machine are, of course, secret, but it's a good bet that die cast engine blocks won't be overlooked.

INCREASED SAFETY IN HANDLING for both shippers and consumers is the reason for the new shape ingot which has been introduced by Aluminum, Ltd.

Called the "Tri-Lok" ingot the new design prevents slippage in any direction. When strapped together in bundles, the ingots are locked against slip vertically, laterally and lengthwise. When unstrapped the bundle is stable and free standing yet individual ingots can be lifted out easily.

The new ingot has a wasp waist to accommodate steel strapping bands. This effectively prevents fingering during transit, even when the load is subjected to three times normal humping speeds.



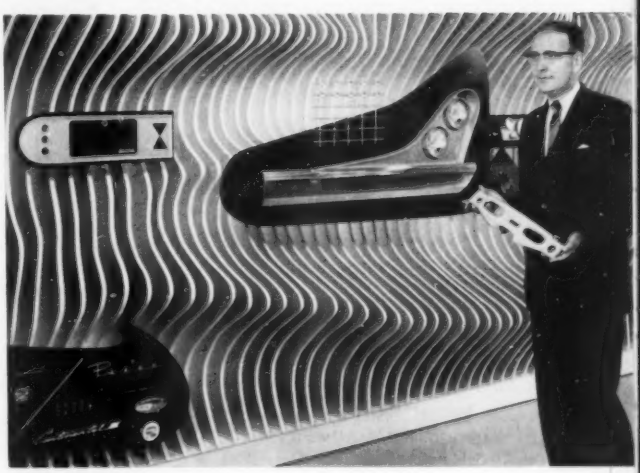
For the consuming plant the ease and safety of stacking and handling will materially shorten the time required for unloading and storage. Even broken bundles can be safely handled by fork trucks.

CAST AND EXTRUDED ALUMINUM TRIM is becoming more important in today's passenger automobiles. In spite of a 31 percent drop in passenger car production last year, the use of aluminum on exterior and interior trim showed substantial gains over any previous year. About 42 million pounds of aluminum went into the 1958 cars – a gain of 8 million pounds over the previous year in spite of a drop of 1.9 million units.

Speaking for the industry in general, Frederick J. Close, Alcoa vice president, forecasts a still greater use of these parts in the future.

Two of the outstanding developments which are expected to step up the use of aluminum are the aluminum bumper and the head light assembly.

The driving force toward the greater use of aluminum trim is the metal's ability to take any form, a multitude of textures and varied colors.



METALS THAT WORK AT 5000°F – impossible – not if further progress in ultrasonic flight is to come. As speeds for both manned aircraft and for missiles go up, so do the temperatures that the metal components must stand.

Looking toward the day when metallic components will withstand these excessively high temperatures, Sylvania Electric Products, Inc., has built a new laboratory for its chemical and metallurgical division. These high temperature materials will be only one of the problems for the new facility.

But before any new material can be accepted for use at these ultra-high temperatures it must be fabricated. This work must, therefore, go hand in hand with the development of high temperature metals and alloys.

Both tungsten and molybdenum are eminently suited for work at very high temperatures. Their fabrication, however, still presents problems.

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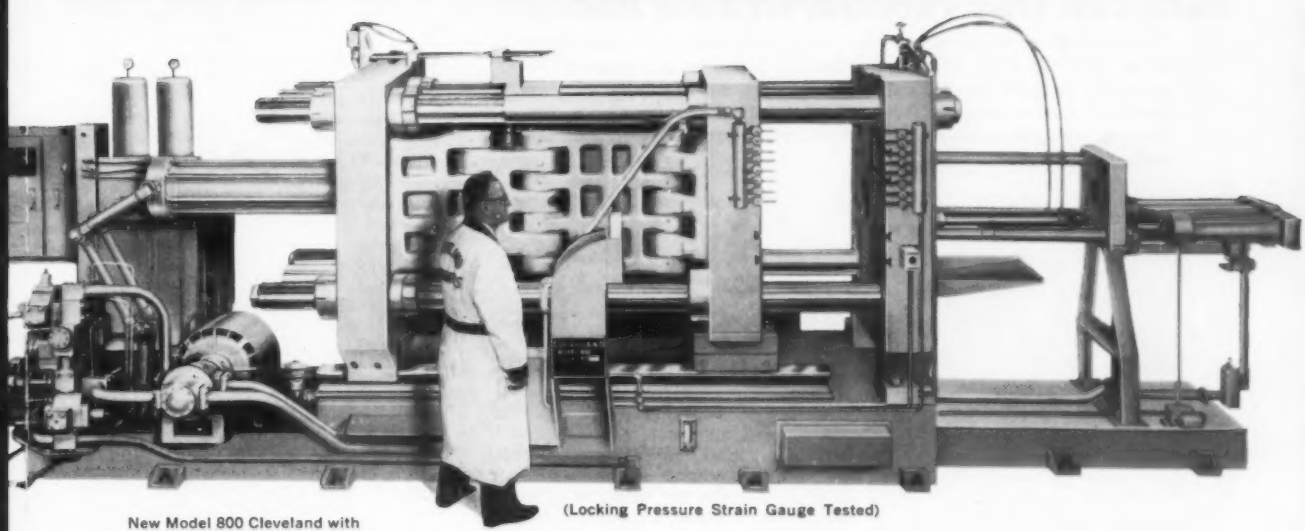
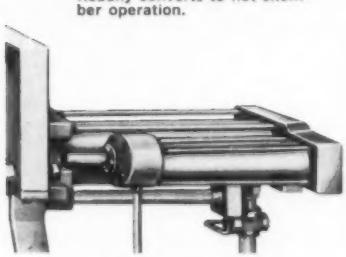
NEW 800 TON CLEVELAND Hydraulic Die Casting Machine



(Locking Pressure Strain Gauge Tested)

New Model 800 Cleveland with cold chamber shot end. Machine weight is 281¼ tons. Readily converts to hot chamber operation.



Incorporating an intensifier, new Cleveland cold chamber shot end provides high pressures on metal; high plunger speeds (both adjustable).

Now available for producing castings up to 20 lbs. aluminum, 46 lbs. zinc. This *big*, newest Cleveland has 55″ x 54″ die plates; 33″ x 33″ space between tie bars; 38″ max. to 20″ min. die thickness; 15″ to 24″ die opening. Massive toggle system, with 7″ dia. tie bars and cross head guide bars, 9½″ thick platens, insures extreme rigidity and positive die alignment . . . with *guaranteed* 800-ton locking pressure!

A highly advanced design of cold chamber shot end, incorporating an *intensifier*, assures top-quality, dense castings. Shot plunger speed, after its initial slow, forward movement, can be adjusted to attain any speed up to 500 f.p.m. At any predetermined plunger position, the shot intensifier can be activated to generate plunger pressures up to 20,000 p.s.i. Intensifier pressure is also adjustable. Throughout, the new Model 800 is *Cleveland-engineered* to give you highest casting quality with utmost reliability of machine performance. Call in a Cleveland sales engineer, or write direct, for machine specifications.

Remember, Clevelands Cut Costs!

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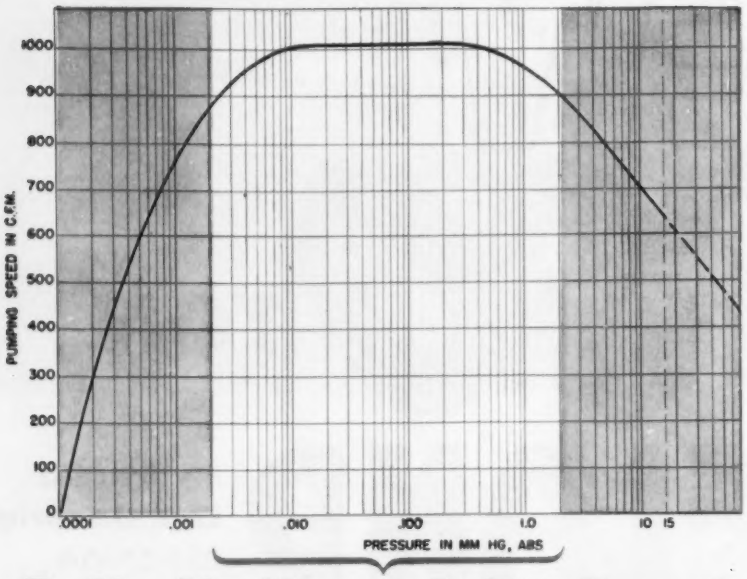

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Please send me copy of Bulletin No. 3180.1 describing KINNEY KMB High Vacuum Pumps.

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CASTING ABOUT

continued from page 10

THE TITANIUM INDUSTRY is showing a strong recovery. During 1958 there was a steady rise in consumption from the low hit in late 1957. While last year was the first one in the last eight which did not show a gain over previous years, the industry seems to be getting onto a more stable foundation. Gradual market diversification is the most helpful sign.

Most encouraging is the increased use of titanium in commercial aircraft; a 50% increase last year over 1957. In spite of high per pound costs, it makes sense to use titanium with a factor of $20 per pound of weight saved on short range aircraft and as high as $240 per pound of weight saved on transoceanic aircraft. Usually the values quoted are that it pays to spend from $40 to $93 per pound for every pound of weight saved. Even these lower figures are impressive.

Military aircraft is taking a good chunk of titanium production, but it's liable to be an unstable business since defense plans can change radically over night. Two programs of the military which may take considerable amounts of titanium are in the Mach 3, B-70 bomber, and the F-108 fighter.

In the missile field, much of the titanium used went into prototype production of liquid fueled units. As these units go into production shipments of titanium into these markets should increase.

Another potentially important market for the metal is in the chemical industries. Particularly in those areas where wet chlorine, metal chlorides, inorganic chloride salts and oxidizing organic chlorinations. Other areas in the chemical industry are being investigated and may prove fruitful.

Over the years alloy development has produced stronger and stronger materials with, correspondingly, lower prices. For example in 1951 commercially pure titanium was available with a tensile strength of about 80,000 psi. In 1959, all beta sheet with a tensile strength of 210,000 psi is available. During this same period the price of mill products dropped from over $15.00 per pound to $8.66 per pound in 1958. Further price declines are probably in the offing as consumption goes up.

LETTERS

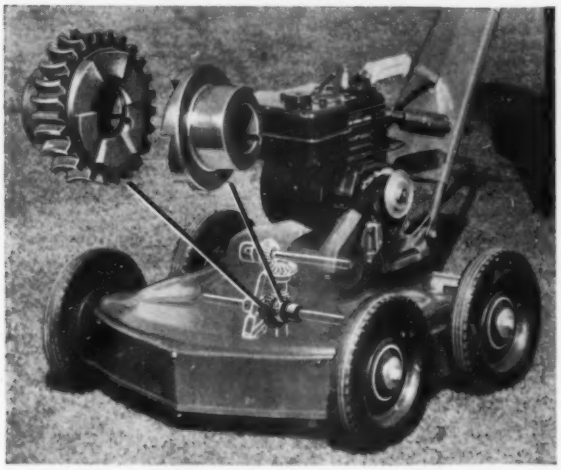
continued from page 9

Could you also send us a reprint of the article "Steel for Die Casting Dies". We would also like to have the address of the Shaw Process Development Corp. — J. M. Process Eng.

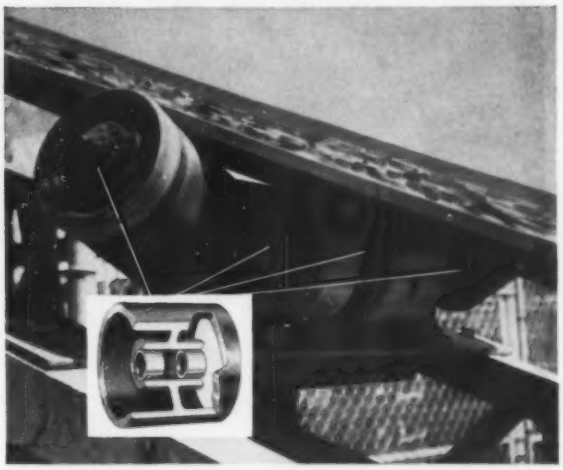
The reprints requested have been forwarded to this reader. The address requested is: British Industries Corp., 80 Shore Rd., Port Washington, New York. — ed.

For more information circle No. 16 on the Reader Service Card

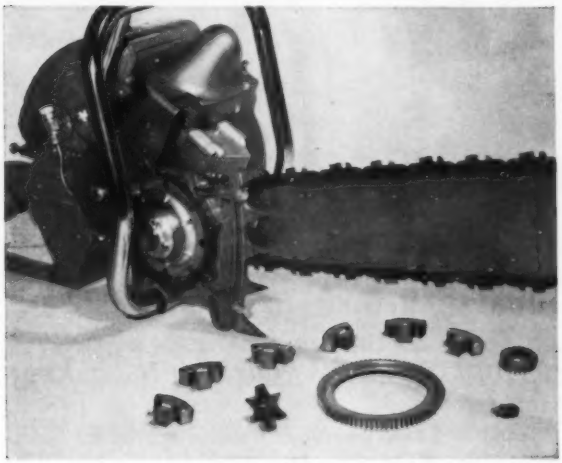
BOOST PRODUCT APPEAL with OILITE



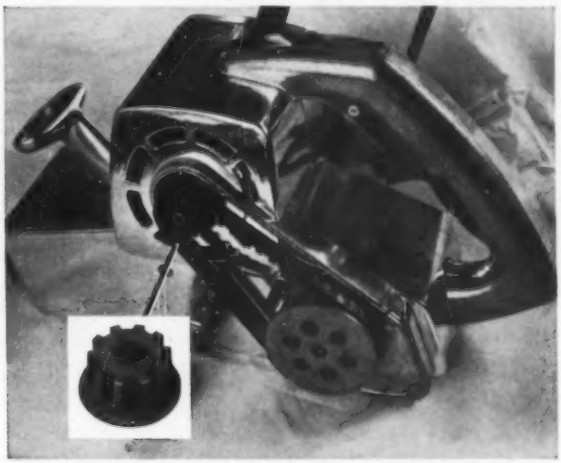
These 2 Oilite components now do the work of 4 former machined parts . . . contribute new economy, less upkeep.



Not one "squeak" from this conveyor . . . yet the dirt-encrusted Oilite bearings haven't been lubricated in 7 years.



Tough, wear-resistant Oilite gears, sprockets and clutch shoes keep costs low . . . make power saw more dependable.



The Oilite pulley of this heavy-duty belt sander provides yet another example of improved performance at less cost.

Quality-built OILITE®* parts and bearings add sales appeal to many fine products. For one thing, close tolerance Oilite parts wear less, weigh less and are quieter running . . . and Oilite bearings are tougher, maintenance-free.

** Only Chrysler Makes Oilite*

For another, Oilite components drastically reduce cost by eliminating material waste and costly machining. Why not contact your Oilite representative today? Look for him in the Yellow Pages under "bearings — Oilite" or write Dept. L-2.

PM PM MEMBER SINCE 1929

A CHRYSLER PRODUCT OILITE

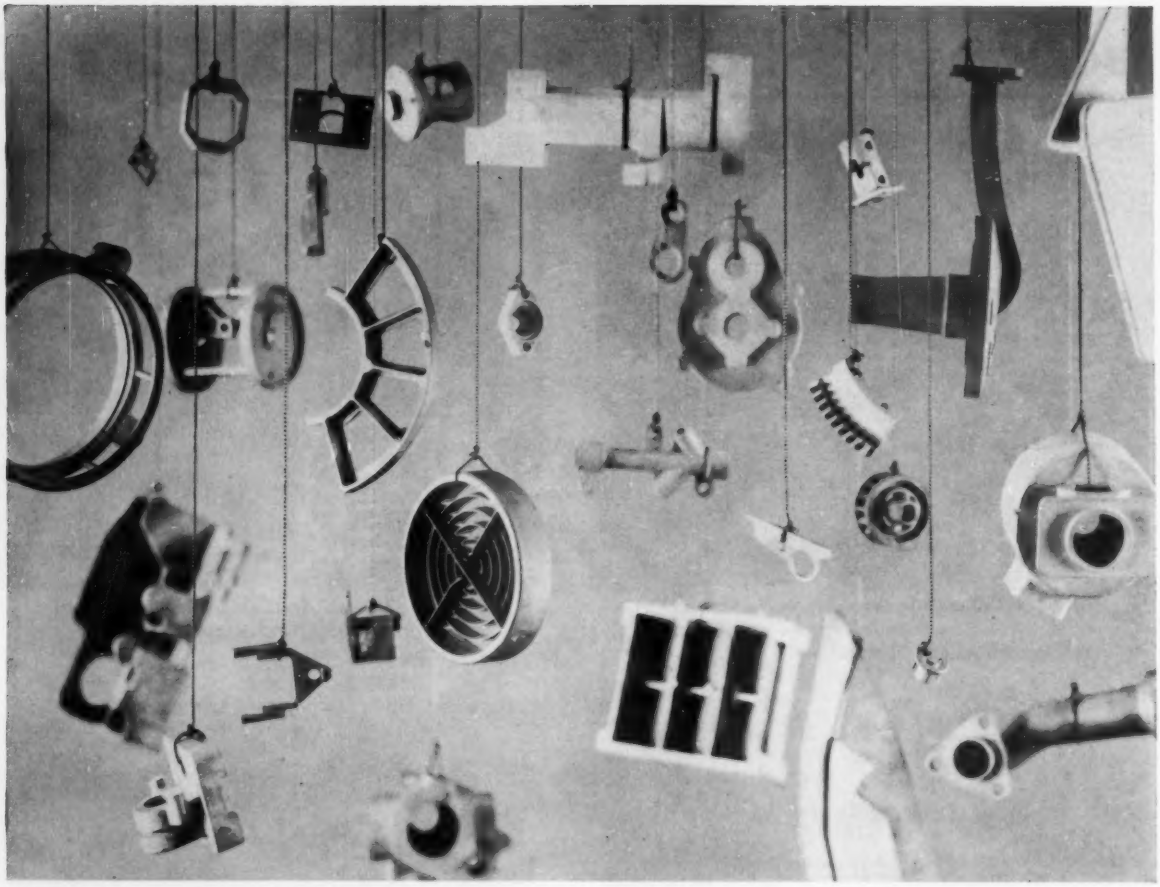
the most trusted name in powder metallurgy!

AMPLEX DIVISION

CHRYSLER CORPORATION, DETROIT 31, MICHIGAN

SELF-LUBRICATING BEARINGS • PRECISION PARTS • METAL FILTERS • FRICTION UNITS

For more information circle No. 15 on the Reader Service Card



This assortment of castings represents about half the number of new parts that go into production at Arwood's four plants in a typical week.

Arwood solves twice this many design problems each week!

Could Investment Casting help you?...a prompt answer is yours for the asking

Upon receipt of a drawing or sample of your part, Arwood will give you a prompt, honest appraisal, spelling out exactly what we propose to furnish. We will also suggest minor design changes that may save you money without affecting the part's performance.

Arwood can handle the complete job, from design and tooling through to finish machining, in any castable metal or alloy. Arwood assumes complete responsibility . . . your procurement problems are at an end.

Arwood's four fully-equipped production plants and well-staffed tool rooms are geared to give fast service. Each job is individually scheduled to assure you of delivery of finished castings in the shortest time possible.

Large and small companies come to Arwood for quotations at the rate of fifty a day . . . without obligation. Why not let us help *you* evaluate the potential savings you may realize by making your part an Arwood investment casting?

Write today for your free copy of the new 44-page Arwood Manual of Investment Casting. Provides all the information you need to evaluate the technique and use it to help solve your design problems.

arwood

ARWOOD PRECISION CASTING CORP.
323 West 44th Street, New York 36, New York

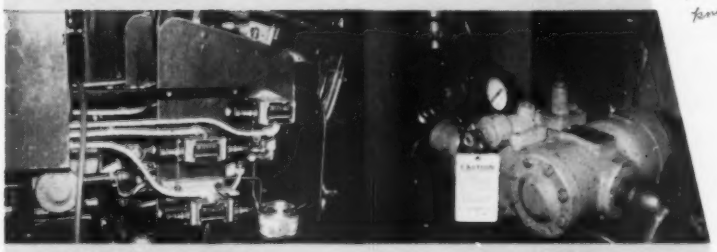
A complete service from design through tooling, production and finish machining. Sixty-two engineering consultants from coast to coast.

PLANTS IN BROOKLYN, N. Y.; GROTON, CONN.; TILTON, N. H. & LOS ANGELES, CALIF.

For more information circle No. 11 on the Reader Service Card

"thank you ... for my husband's life"!

"If Mel had used oil (which is commonly employed) in the hydraulic lines he would have been enveloped by a blazing inferno! But thank God! *Houghto-Safe* was in the lines!"



"Mel was standing here at time of 'blow-up'." Fluid still dripping from lines when photo was taken.

Pump with Houghto-Safe fill tag. Faulty fitting was at right of motor.

DO YOUR MEN HAVE THIS PROTECTION?

Why take chances in your own shop, if men are working around hot metal, open flames, or other high temperature hazards? Even under low pressures, hydraulic fluid can spray up to 40 feet if a line breaks. You need Houghto-Safe protection! And with Houghto-Safe protection, you get top hydraulic efficiency and better-than-ever protection against pump wear.

Now's the time to protect your plant and personnel from disastrous explosions and fire. Call your Houghton Man today. Or write E. F. Houghton & Co., 303 W. Lehigh Ave., Phila. 33, Pa.

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a product of

E. F. HOUGHTON & CO.

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Ready to give you on-the-job service

For more information circle No. 27 on the Reader Service Card

A Completely Self-Contained High-Frequency Induction Melting Unit That Can Be Installed In 2 Hours

Ideal for Air or Vacuum Melting, Sintering and Hot Pressing

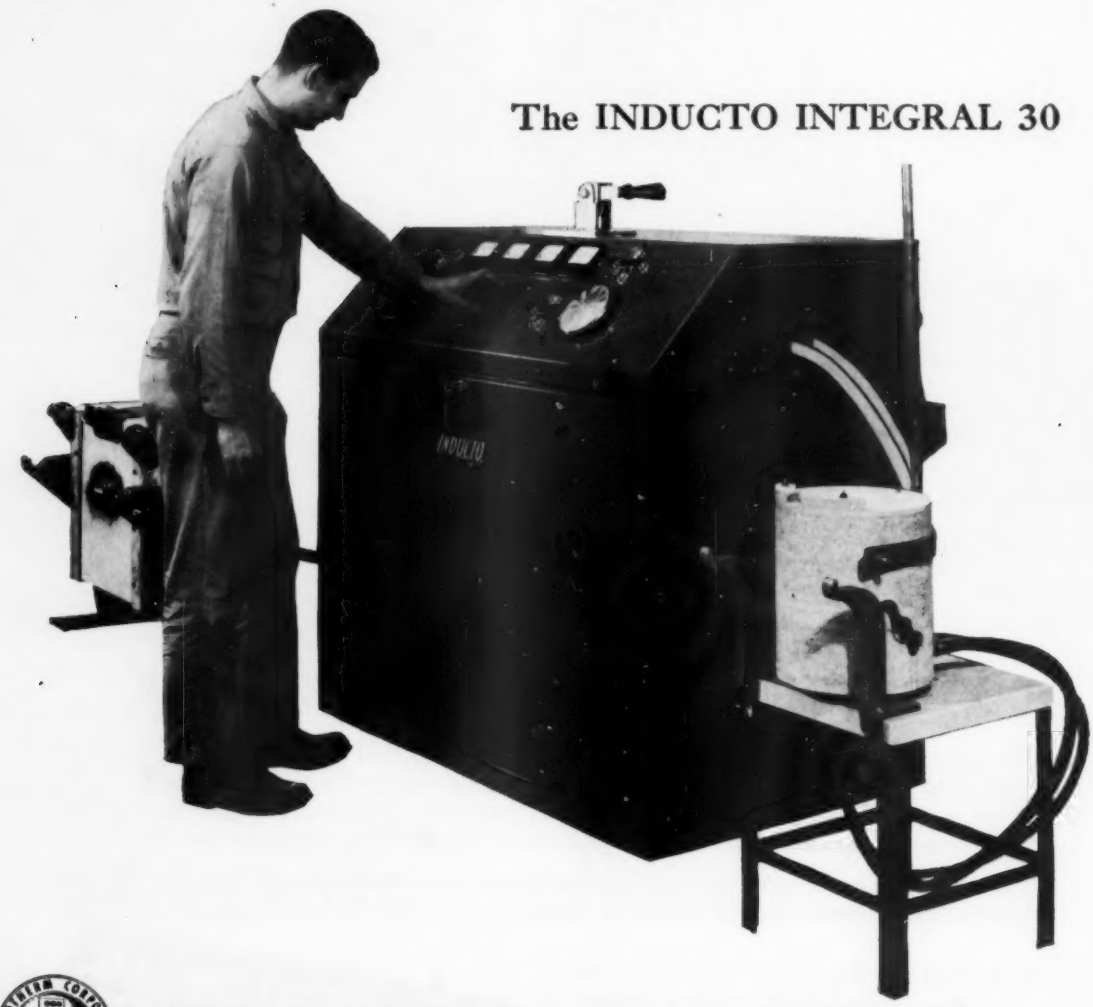
The Inducto Integral 30 is an efficient and economical melting unit that can be easily adapted to a variety of applications. Its console control panel contains all the equipment necessary to operate high-frequency induction furnaces and coils—a motor-generator set, capacitors, transformer and complete controls. Over 20 capacitor and 8 transformer steps, easily controlled from the front, provide the necessary flexibility to assure matching full power to all load conditions throughout the heating or melting cycles. The entire unit is designed for maximum dependability and ease of operation.

The Integral 30 is installed simply by connecting it to a 220 or 440 volt power supply, a cold water line and a drain. In fact, it is so compact and easy to install anywhere, the console can be made portable just by mounting it on casters.

Unique water-cooled leads simultaneously supply power and water to the furnaces. The same leads, with slight modifications, provide an economical power entry system for vacuum melting applications.

The Integral 30, with all the advantages of induction melting and Inducto engineering features, is truly the outstanding melting unit in the 5 to 100 pound range. No other equipment can offer you the same versatility, efficiency and economy. For complete details, write for Descriptive Bulletin 20-30, Inductotherm Corp., 412 Illinois Ave., Delanco, N. J.

The INDUCTO INTEGRAL 30



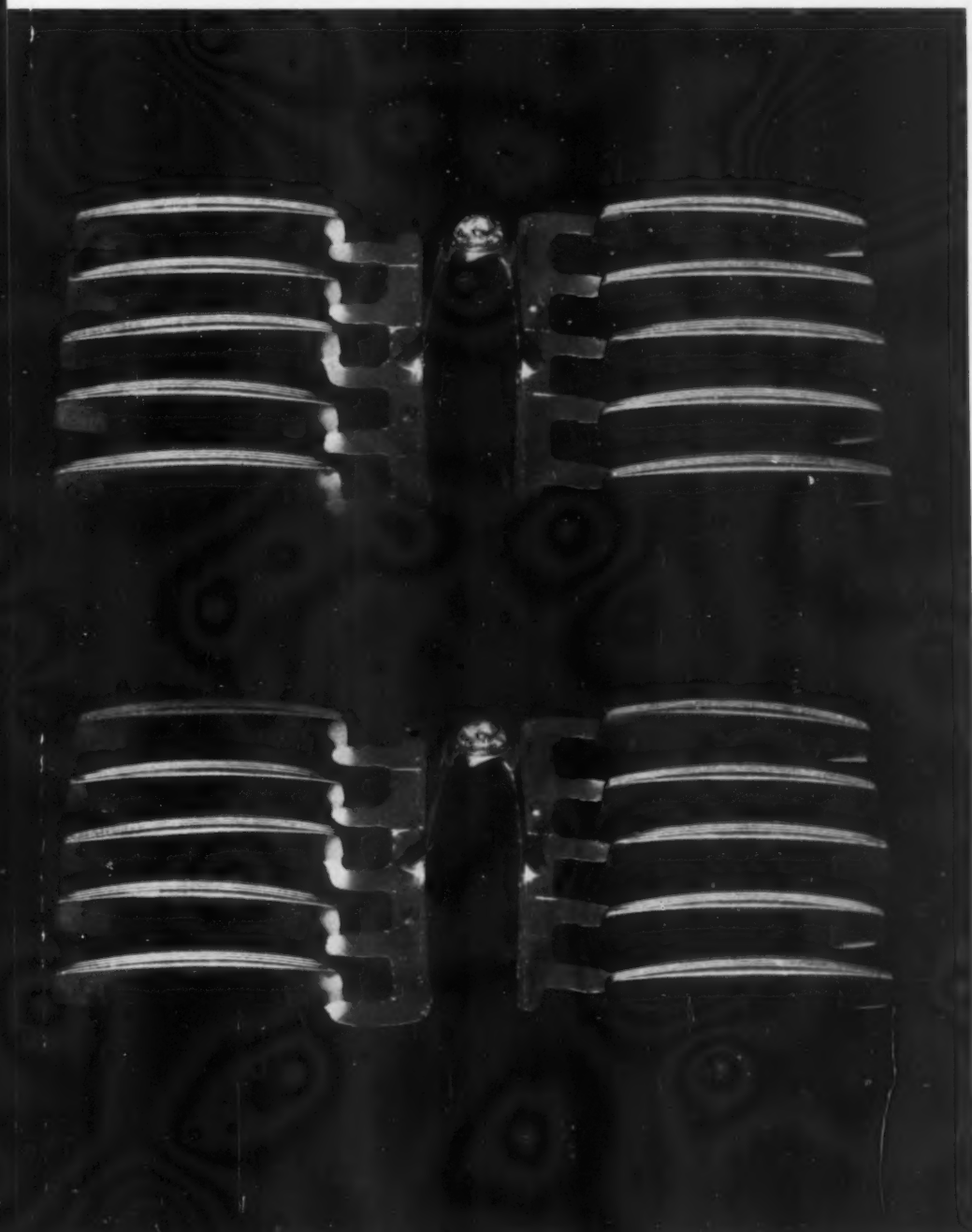
INDUCTOTHERM

INDUCTO ... the mark of modern melting

For more information circle No. 29 on the Reader Service Card

Completely controlled production provides you with die cast metals of highest purity and uniformity. Federated Di-Metal is made from special high grade zinc, electrolytically refined by Asarco-developed processes. Production is now concentrated "under one roof" at Corpus Christi, Texas, one of the world's largest plants producing special high grade zinc. Integrated production—controlled from mine to finished alloy—assures you of lower cost Zinc Di-Metal of the highest purity and uniformity. Federated can serve your Di-Metal needs through 22 sales offices throughout the country. There's one near you. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF



ASARCO

AMERICAN SMELTING AND REFINING COMPANY

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Building, Pittsburgh 22, Pa. Address Dept.PM-14

WSW-7299

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

For more information circle No. 3 on the Reader Service Card

DENISON *Announces...*

a new hydraulic COMPACTING Multipress line in capacities from 2 to 75 tons

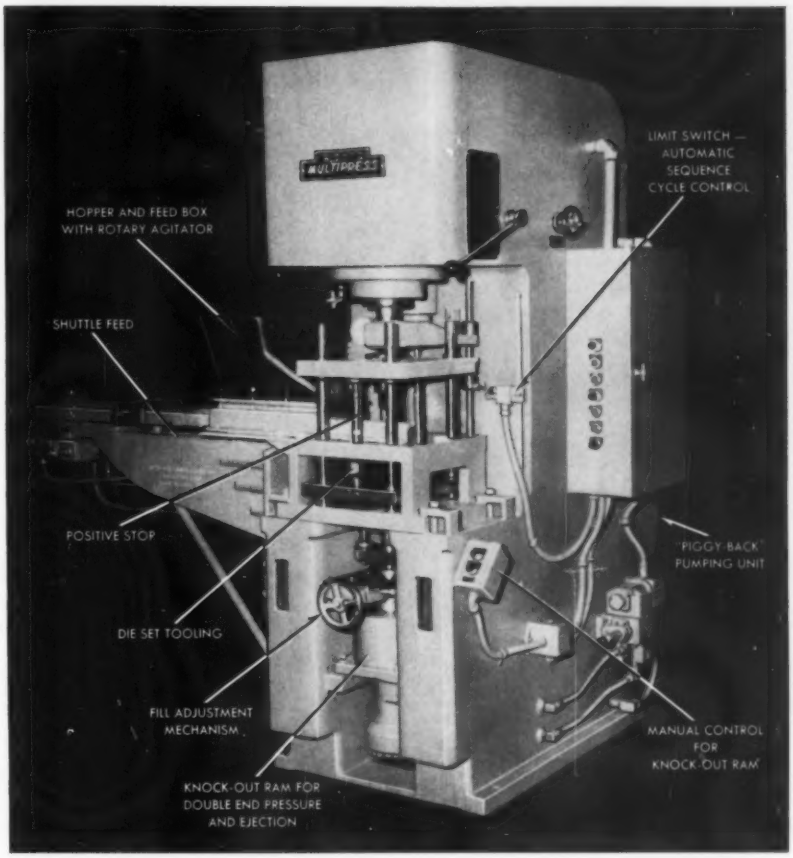
ELIMINATES SCRAP LOSS
Hydraulic ram pressure and speed controls are adjustable *up and down.* Timing prevents fracture of parts (due to vacuum) at time of ejection.

UNIFORM FILL AND DENSITY produce duplicate, uniform quality from part-to-part . . . even for thin, ring-type parts. Production is done to *extremely close tolerances.* Three exclusive features help make this possible: Ram pressure reversal, retractable core pin and two types of feeders available . . . rotary agitator or vibratory grid.

BUILT-IN SAFETY—Adjustable limit-switch settings and positive stop regulation guard the sequence operational cycle of the 3 hydraulic rams. Overloading the die is prevented—resulting in *longer die life* with less breakage.

UNIFORM CROSS-SECTIONAL DENSITY of compacted parts is assured by application of double-end pressure. And, where necessary to improve density, exclusive *Vibratory Ram Action* can also be applied.

ADJUSTABLE FILL FEATURE allows adjustment of the volume capacity of the die even while the press is in operation. Result is fast, simple setup changes—and ability to *compensate for variations in material* (particle size, moisture content, etc.) from batch to batch.


MULTIPRESS
LIMIT SWITCH — AUTOMATIC SEQUENCE CYCLE CONTROL
HOPPER AND FEED BOX WITH ROTARY AGITATOR
SHUTTLE FEED
POSITIVE STOP
"PIGGY-BACK" PUMPING UNIT
DIE SET TOOLING
FILL ADJUSTMENT MECHANISM
MANUAL CONTROL FOR KNOCK-OUT RAM
KNOCK-OUT RAM FOR DOUBLE END PRESSURE AND EJECTION

New Hydraulic Compacting Presses . . . from Denison feature exclusive shuttle-feed with rotary agitator for compacting—powdered metal, plastics, "teflon", ceramics, food products, chemicals, pharmaceuticals, carbon, asbestos, ground cork, powdered glass, plastic-impregnated fibrous material, uranium oxide, fertilizer, abrasives. Denison Multipress offers fabricators many unique quality-control, cost-saving production advantages.

Write for full details in Bulletin M-11-B

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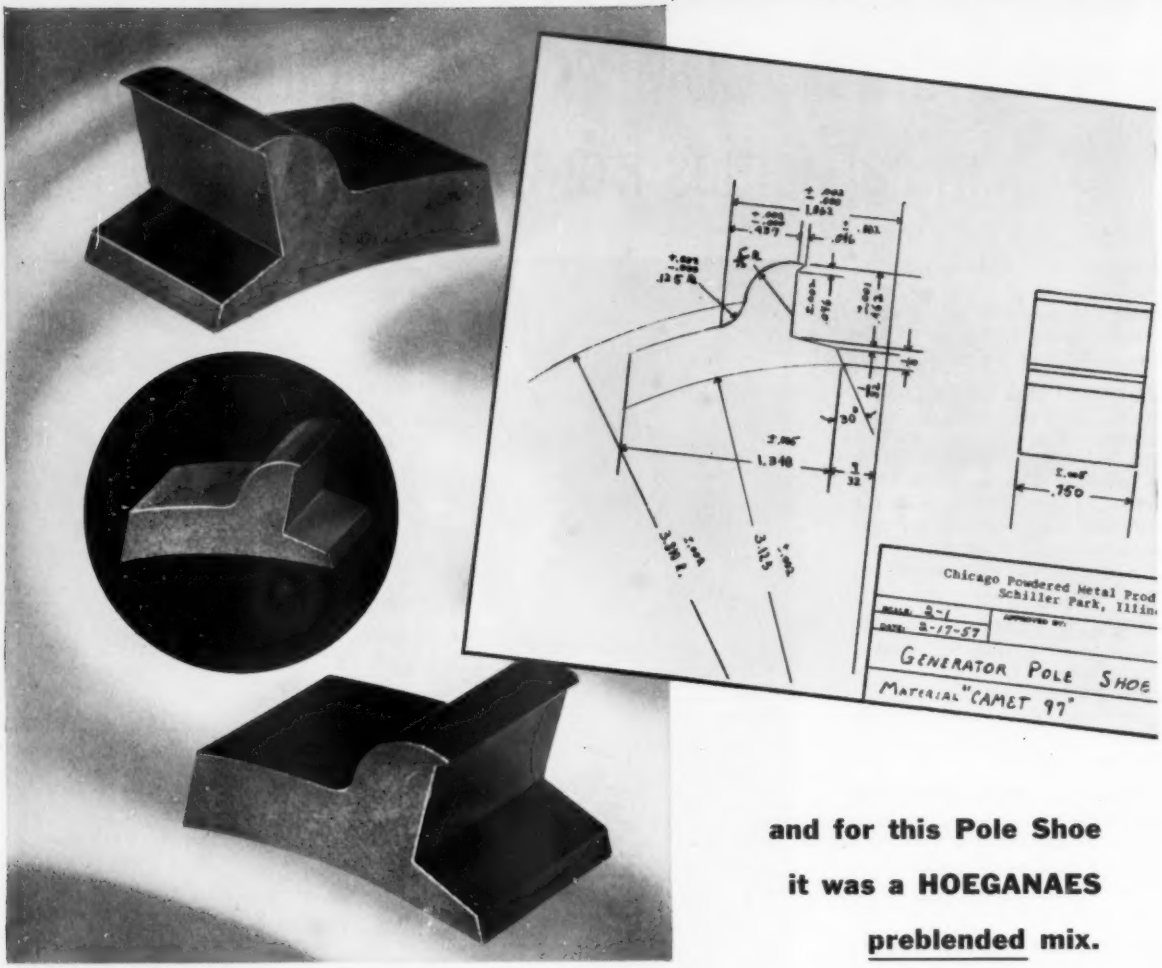
For more information circle No. 6 on the Reader Service Card

We rely on the powder producer to ship *uniform* material ...states CHICAGO POWDERED METAL PRODUCTS COMPANY



and for this Pole Shoe it was a HOEGANAES preblended mix.

Mr. John E. Miller, president of Chicago Powdered Metal Products Company, Schiller Park, Illinois, had but words of performance praise for Hoeganaes *preblended* RX-1030 Iron Powder.

Praise that went like this. "Our main desire is to have complete customer satisfaction. Part of this responsibility lies with Hoeganaes because we expect and receive uniform *preblended* powders from lot to lot, as well as within each lot. In fabricating, we found many advantages—Uniformity ● Increased production (less adjustment) ● Higher pressed densities at less tons per square inch ● Increased tool life ● Improved sintered strength Greater dimensional control ● Increase in quality and quantity of production."

Any one of these reasons is a good reason why you should call in a Hoeganaes Engineering Specialist to confer on your fabricating problems. Remember, he's at your service.

HSIC

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

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You get the combined experience behind these 4 emblems--

This Dollin emblem on your die-castings assures maximum quality and economy, resulting from Dollin's advanced equipment, methods and experienced craftsmen.

Dollin is a supporting member of the American Die-Casting Institute which sponsers research to improve methods, raise standards and broaden applications of die-castings.

Dollin is a licensee of the Certified Zinc Alloy Plan, which assures conformity with industry standards of chemical control and metal purity through independent checking.

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Dollin is a participating member of the Die-Casting Research Foundation, comprising over 100 die-casting companies engaged in cooperative research to improve production techniques and equipment.

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DOLLIN

DIE-CASTING FACILITIES

DOLLIN spares no effort to keep in the forefront of developments in die-casting design . . . die-making . . . foundry practice . . . casting . . . machining . . . inspection. Learn how Dollin's extensive, modern, high-production facilities can improve quality and cut costs of your zinc and aluminum die-castings, from large parts down to "midget" parts.

Submit prints, or samples of parts, for engineering advice and quotation.

Dollin Corporation, 614 So. 21st St., Irvington 11, N. J.

SALES OFFICES: Boston • Buffalo • Canton • Chicago • Detroit
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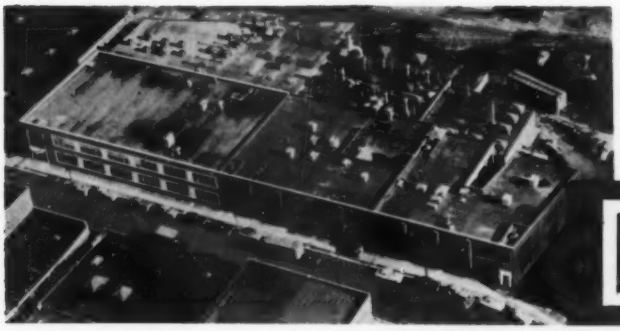
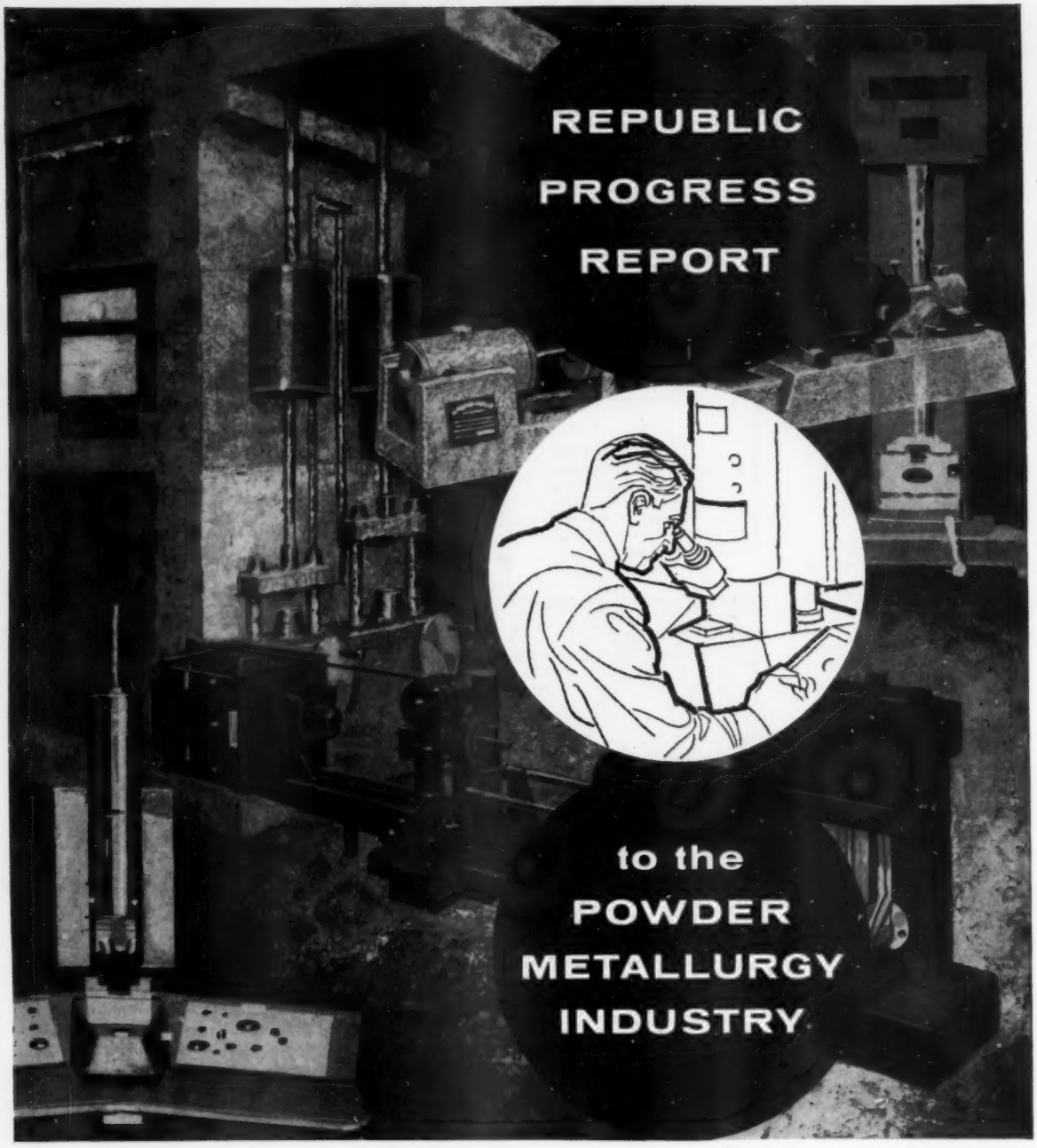
See "Yellow Pages" for nearest office.



DOLLIN Zinc & Aluminum DIE-CASTINGS

For more information circle No. 19 on the Reader Service Card



Data, normally associated with wrought steel products, are now being developed and accumulated on physical property characteristics of Republic Iron Powders Types CDF, MS, and HS 6460. These data will be included with forthcoming information relative to:

- FATIGUE
- IMPACT
- CREEP RUPTURE
- DILATOMETRIC VALUES
- ELECTRON MICROSCOPE STUDIES
- RADIOACTIVE TRACE ELEMENT TESTS

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precise heat for precision casting

You'd *expect* the accurate heat of an induction furnace to be an important consideration in permanent mold, shell mold, and investment casting . . . and it *is!* But in addition to precise temperature control, Ajax-Northrup high frequency induction furnaces provide the precision foundry with *flexibility*, *purity*, and *economy*. That's why Ajax leadership in melting for precision casting has never been challenged.

One furnace—hundreds of alloys: Ajax-Northrup furnaces can handle any one or all of the hundreds of ferrous and non-ferrous alloys being made today. For many alloys, it's the only furnace that *can* be used. Magnet alloys, for example, depend on the inherent stirring action which assures ideal dispersion of all elements throughout a melt . . . and the most uniform possible cast part analysis.

Pure metal protects part quality: There's no flame, no smoke, no physical contact between coil and metal. Melts are always 100% on analysis, because there's no chance of contamination . . . particularly important when you're dealing with the finicky alloys common in precision casting.

A better melt at a lower cost per melt: Because every melt is uniform and to exact composition, bad melts become a thing of the past. Subsequent machining is minimized. Ajax-Northrup's unique control system assures maximum melting efficiency—lower melting costs. And new, compact designs minimize floor space requirements, installation costs and maintenance.

Induction heating & melting

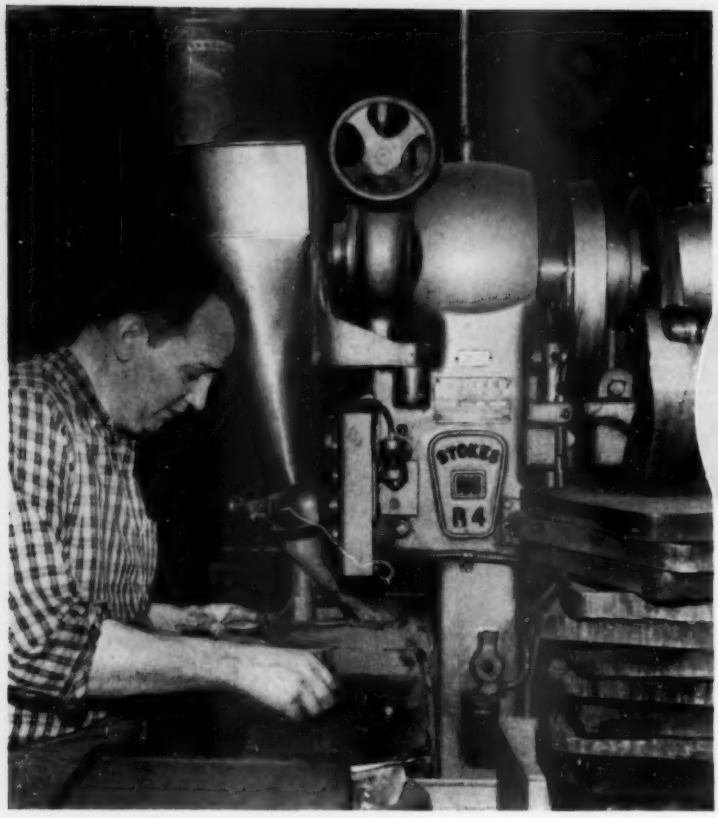
AJAX

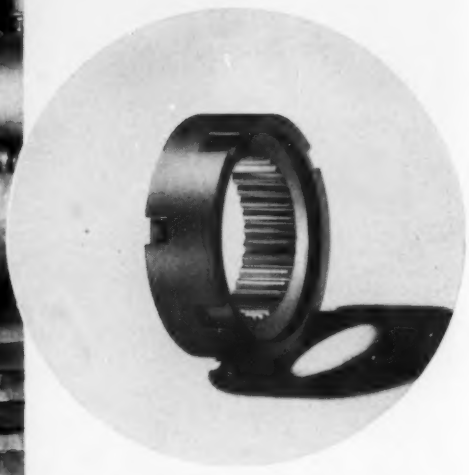
NORTHRUP

Available in every conceivable capacity from a few ounces to several tons . . . powered by massive motor-generator sets or economical converters . . . there's an Ajax-Northrup induction furnace sure to satisfy your needs perfectly. We'll gladly send you further information or, if you wish, arrange a meeting with qualified furnace engineers to discuss your special requirements. Ajax Electrothermic Corporation, Ajax Park, Trenton 5, New Jersey.

ASSOCIATED COMPANIES: AJAX ELECTRIC COMPANY-AJAX ENGINEERING CORPORATION

For more information circle No. 10 on the Reader Service Card





68% SAVINGS were realized on the piece shown above—a tractor part made from an iron base metal powder and having a tensile strength of 65,000 psi and an average hardness of 65 Rockwell B. The part was previously made by screw machine methods. At left, a Burgess-Norton operator checks the output of one of the Stokes R-4 Powder Metal Presses at the company's Geneva, Illinois, plant.

"Quali-SINT"® produced by Burgess-Norton on Stokes powder metal presses

Burgess-Norton Mfg. Co., Geneva, Illinois, is a leading producer of a wide variety of parts by powder metallurgy—including cams, spacers, gears, adapters, ratchets and pawls. The company maintains its own extensive engineering, metallurgical, and chemical laboratories, tool-making, and secondary machining and grinding facilities.

Five Stokes powder metal presses are operated 5 days a week—16 hours a day—to keep pace with their production demands. The number of parts per minute depends on the part and the process being used—only minimum operator attention is required. All 5 presses were chosen by G. W. Waller, Vice President of Engineering, on the basis of "(1)—Production rate per dollar cost, (2)—Minimum maintenance requirements, and (3)—Price."

Continual research and advancement in the field of powder metallurgy has made Stokes the recognized leader in this modern industry. Stokes achievements may well be the answer to meeting your own production requirements economically—and at high speeds. Ask for complete information on the Stokes line of industrial compacting presses—or for assistance by Stokes Engineering Advisory Service. Call—or write—today.

®"Quali-SINT" is a registered trademark of Burgess-Norton Mfg. Co., Geneva, Ill.

Powder Metal Press Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

For more information circle No. 53 on the Reader Service Card

Whatever you sell in the field of powder metallurgy you can reach your customer best in . . .

The 8th Annual

POWDER METALLURGY DIRECTORY

in Precision Metal Molding's April 1959 Issue

PRECISION METAL MOLDING'S April issue will be kept on hand for a full year as a reference and buyers' guide for all who design, specify, buy, produce or process parts made from metal powders

HERE'S WHAT WILL BE INCLUDED:

1. **REFERENCE DATA** — how to evaluate the relative cost of powder metal parts, including a typical work sheet for designers and engineers.
2. **PRODUCT LISTING** — there will be three categories: producers of sintered parts, manufacturers of equipment, producers of metal powders.
3. **ALPHABETICAL LISTING** — all manufacturers in the powder metallurgy field will be included, together with address and list of products.

Closing date March 2 • ***regular rates apply*** • ***reserve your advertising space NOW!***

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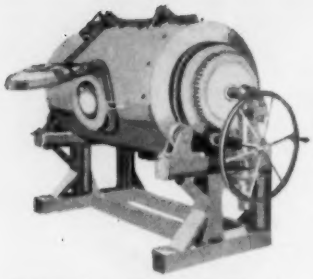
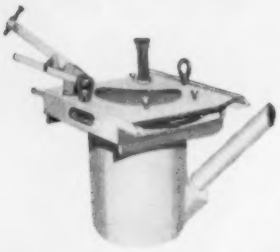
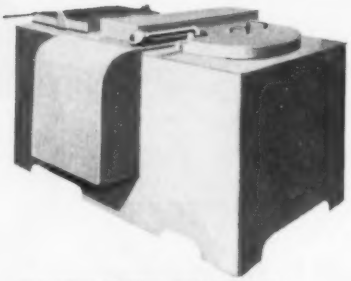
Wherever industry needs heat... There's LINDBERG equipment just right for the specific job



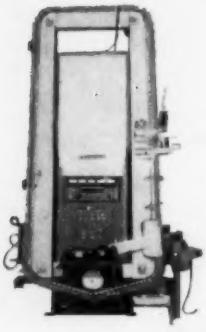
Rotary Open-Flame Smelting Furnaces: Lindberg-Fisher Simplex (shown) either oil or gas fired with capacities to 30,000 lbs. brass, 2,400 lbs. aluminum.



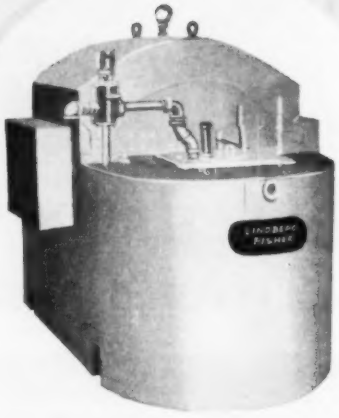
Automatic Ladling Units: The Autoladle "Little Joe". The first practical automatic aluminum ladling unit yet devised.



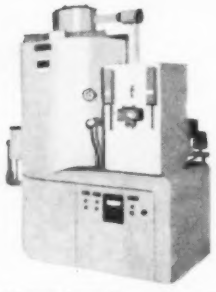
Induction Melting and Holding Furnaces: Lindberg-Fisher two-chamber furnace (shown) melts in one chamber, holds at correct temperature in other.



High Frequency Units: Vertically designed, completely automatic "HF" unit (Shown) for aluminizing automotive valves.



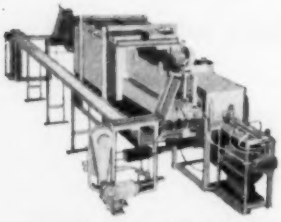
Melting and Holding Furnaces: Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.



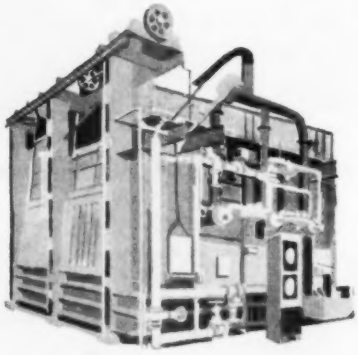
Atmosphere Generators: Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.

Pilot Plant Equipment: Atmosphere tube unit (shown) for ceramic research and development at temperatures up to 2750° F.

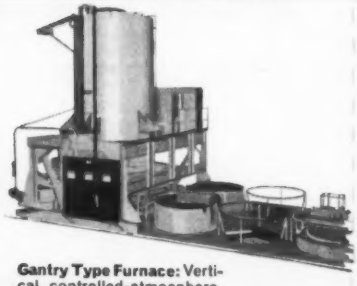
Cyclone Tempering Furnaces: Batch type fuel-fired tempering furnace (shown). Famous in metal treating industry for years.



Ceramic Kilns: Fully automatic, atmosphere controlled kiln (shown) has 5 control zones for flexibility. Maximum temperature, 2700° F.



Aluminum Reverberatory Furnaces: Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.



Gantry Type Furnace: Vertical, controlled-atmosphere, drop bottom, hardening furnace. Complete installation field-installed by Lindberg.

Lindberg-Designed

furnaces, more than 75 of them, help Ford Motor Company maintain casting production and quality standards

The new Aluminum Castings Plant of Ford Motor Company, Engine and Foundry Division, at Sheffield, Alabama, is a model of modern production efficiency. Contributing to its effective operation is a huge battery of Lindberg-Fisher aluminum holding furnaces, more than 75 of them. Eight large 65,000 lb. capacity reverberatory holding furnaces receive molten aluminum delivered from an adjacent Reynolds Metals plant and hold it at the desired temperature. Six other reverberatory furnaces, each with 20,000 lb. capacity, are used for remelting scrap aluminum from trimmed parts and holding metal at its usable temperatures. Molten metal is then delivered to more than 60 electric resistance holding furnaces in the casting area as needed. This unique installation, developed by Ford engineers in conjunction with Lindberg, is a major factor in maintaining the high quality product and production standards required by Ford.

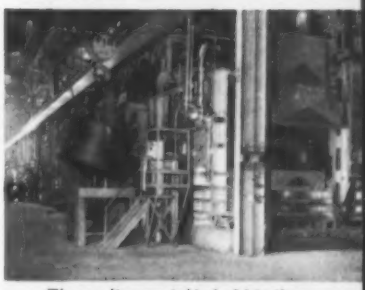
Lindberg equipment and Lindberg planning can help you find the most effective answer to any problem of applying heat to industry. We cover the field, melting and holding, heat treating, tempering, brazing, enameling furnaces, ceramic kilns, high frequency units, and are in the ideal position to recommend just the type of equipment most suitable for your needs. This can be factory built or field-installed in your own plant, fuel-fired or electric. Consult your local Lindberg Field Representative (see the classified phone book) or get in touch with us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California.

Handsome entrance to new plant of Ford Motor Company, Sheffield, Alabama.

Metal temperatures are positively controlled through Lindberg Control Panel.

Some furnaces are arranged for hand ladling and others are equipped with Lindberg Autoladle.

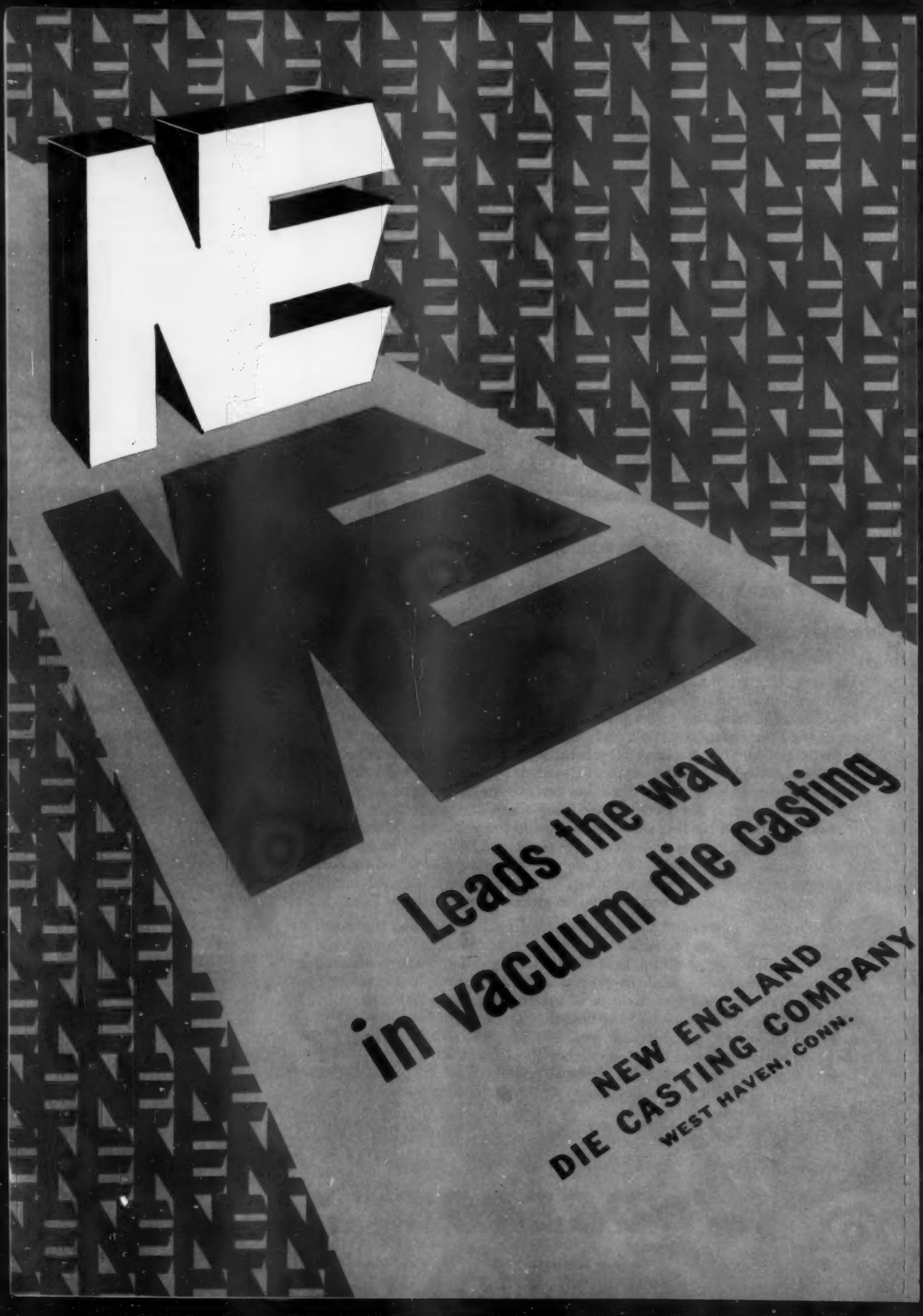
Molten aluminum is delivered direct to reverberatory holding furnaces.



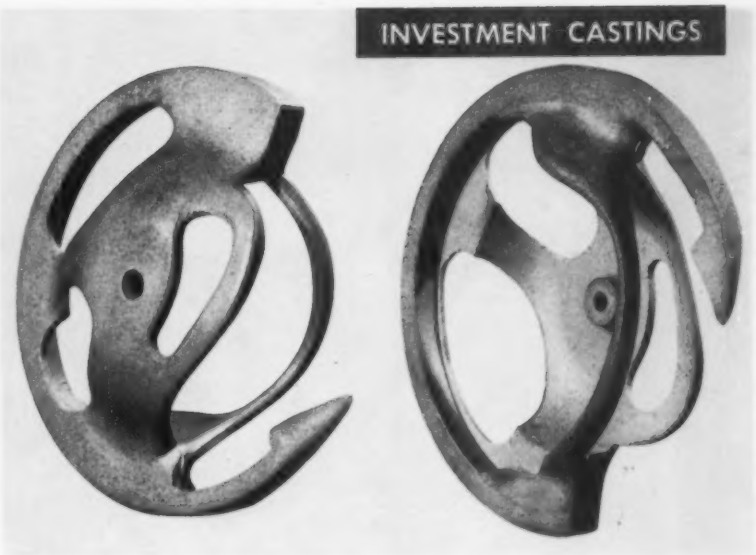
The molten metal is held in these 14 huge furnaces for distribution to the casting areas.

LINDBERG heat for industry

For more information circle No. 35 on the Reader Service Card


NE
Leads the way
in vacuum die casting
NEW ENGLAND
DIE CASTING COMPANY
WEST HAVEN, CONN.

1. REDESIGNING FOR INVESTMENT CASTING made the sewing hook better, less costly, and more adaptable to a variety of machine models.



COVER STORY

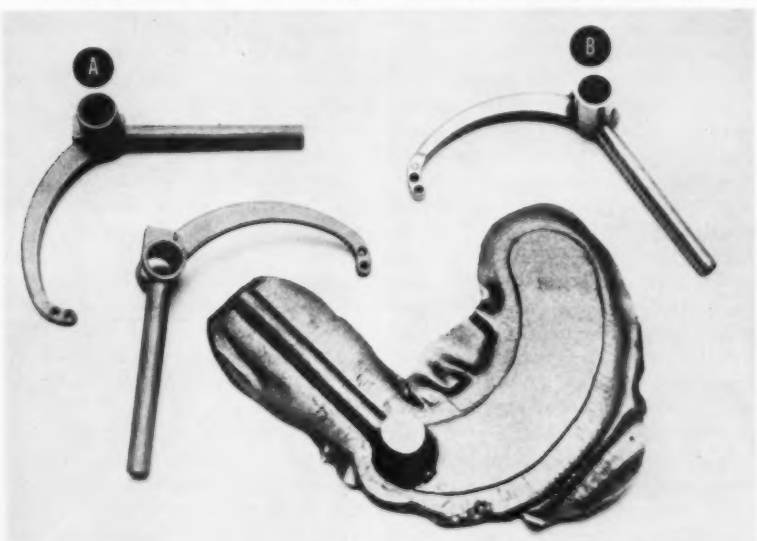
When You Redesign — MAKE IT BETTER

REDESIGN has two main objectives – to improve a product or to lower the manufacturing cost. When both of these aims can be gotten, redesign really pays off. It paid off for Singer Mfg. Co. on at least two parts.

THE TAKE-UP LEVER

Figure 2 shows the take-up lever for an industrial sewing machine. The lever was first designed as a forging as shown. (fig. 2A). To make the part, start with a rough forging, then normalize and anneal.

2. ELIMINATION OF FORGING, TRIMMING AND MACHINING as well as a brazing operation were the advantages of redesign to investment casting.



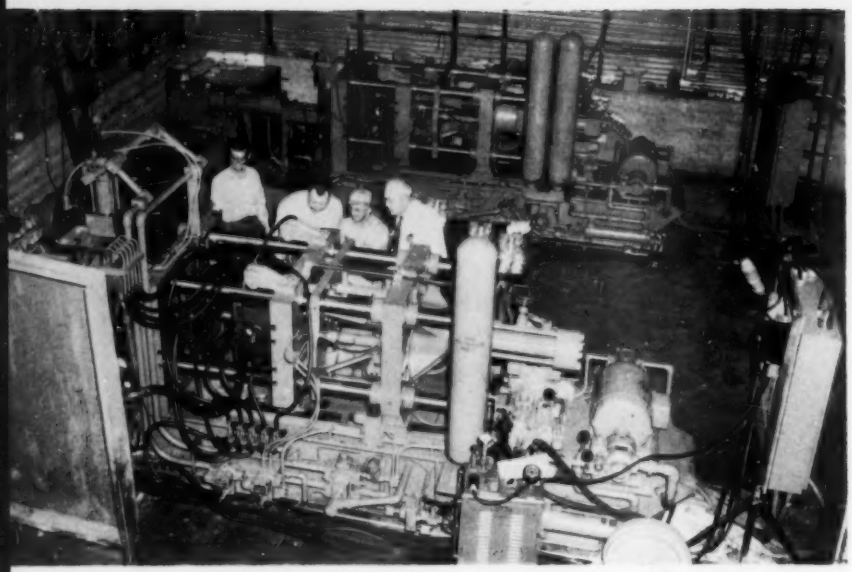
Next the forging was trimmed and an arm section blanked out and coined. Then another anneal followed by drilling and turning the hub. Two small holes were drilled in the end of the arm and the piece carburized.

During carburizing, the parts generally warped so that a straightening operation on both the shank and arm had to be done. After carburizing and straightening the lever was hardened, then straightened again. Finally the I.D. of the hub and the O.D. of the shank were ground. The part was finished, sure, but it took fifteen operations and was expensive.

Singer engineers working the Casting Engineers, Inc. decided that an investment casting in a heat-treatable steel would give a stronger part at lower cost (fig. 2B). Because there was a strong repeat business in this item a tool steel mold was made and to insure dimensional stability polystyrene patterns were selected.

As an investment casting the lever could be made with a steel insert so that tooling costs on an

continued on page 56



VACUUM EQUIPPED LABORATORY MACHINES. Foreground hot chamber machine with die temperature control and vacuum. Background 400 ton cold chamber machine with vacuum.

Die Casting Under Reduced Atmospheric Pressure

In earlier issues of PRECISION METAL MOLDING, the different methods of producing die castings with the die cavity partially evacuated were discussed. Systems covered were those developed by Reed-Prentice, New England Die Casting and Morton Mfg. This article will discuss the "vacuum" die casting system developed by B & T Machinery Co.

The different companies who promote systems for evacuating the die cavity just before the metal shot is made are in good agreement about the value of, and reasons for using reduced atmospheric pressure. Where they differ is, how the cavity should be evacuated.

The vacuum system developed by B & T Machinery Co. varies from others by evacuating the shot sleeve and the die cavity through the pouring hole after the metal has been ladled.

But simple removal of air is not sufficient to produce the best castings. When hot metal hits the lubricant coated die there is always vaporization of some of the lubricant. This vapor can have just as adverse an effect on the casting as the original air. It must, therefore, be removed as rapidly as it is formed. The secondary vapor removal is done through the ejector box. Here's how the system works.

Primary evacuation is secured through the cold chamber. This vacuum line and the air shut off cover are shown in figure 3. To secure, and maintain, the desired low pressure both the ejector box and the die parting must be sealed.

The sides of the ejector box are sealed with steel plates and gaskets. Die shoes are bolted to an adapter plate in which are drilled the pattern of ejection holes corresponding to a particular make of die casting machine. The bumper pin holes are machined about ½" larger than the pins for easy alignment.

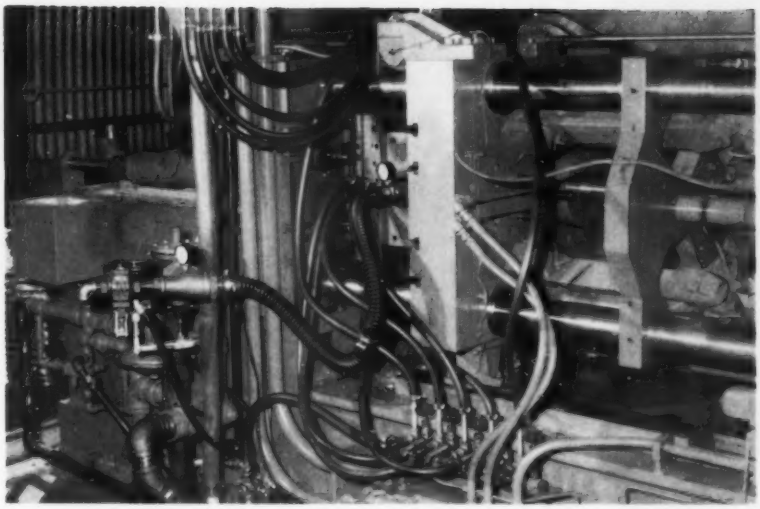
Reduced pressure is held in the ejector box by a seal of ¼" thick rubber sheet. This sheet is bolted to the back of the ejector plate and has holes cut in it which correspond to the traveling plate. Collars are welded to the inside of the base plate that are 1/32" longer than the distance from the back of the die shoe to the ejector plate seal. Thus, when the dies are fully closed these rings compress the rubber sheet 1/32" to seal off the possible air leakage around ejector pins.

At the parting line of the dies a neoprene gasket is used. The grade of material used will stand temperatures up to 350°F. and is set back from the parting line so that any flash will not burn the rubber.

In normal operation, the operator ladles a shot. He then closes the cover over the shot port and in doing so energizes a switch which opens the vacuum valve. About ¼ second or less is required to reduce the pressure in the shot cylinder and the cavity to from 26" to 28" of mercury. A timer automatically trips the shot plunger when evacuation is complete.

At the time the main vacuum valve is opened, the auxiliary valve into the ejector box is opened. As soon as the piston passes the pouring hole the main valve is closed but the auxiliary valve remains open so that continued withdrawal of vapors from the chamber is made during actual injection of the metal.

The shot is rammed home and the vacuum held on the parting line and ejector box through a second timer until the piston reaches the end of its travel. At this stage, the ejector box is opened to the atmosphere. The balance of the



1. SOLENOID VALVES and flexible hose connection on a vacuum equipped hot chamber machine. Valves are timed to machine cycle.

2. PUMP AND ACCUMULATOR for a three machine vacuum set-up.

cycle is normal.

Auxiliary equipment for this vacuum system is about standard. Sufficient surge tank capacity must be supplied so that there is very little pressure change in the system when the die cavity is evacuated. Generally a receiver of about 150 cu. ft. is desirable. Such a receiver will generally handle three machines. A vane type pump such as a Kinney Vacuum Pump has been found most desirable. An H-130 Kinney pump is adequate for a 150 cu. ft. receiver and three machines. Pipe and hose lines should be as large as possible and not less than 3″.

Costs of installing a three machine vacuum system will, of course, vary. Some average costs are pump $1740.00, receiver $750.00, conversion of machines $1900.00 for the first and $1700.00 for each of the others. In addition there are minor items such as motors, installation labor, etc.

Die conversion costs are variable but thus far have averaged about 50 man-hours labor. On new die construction where vacuum casting is anticipated there will be little, if any, additional die construction costs other than to provide the parting line seal.

This system of vacuum die casting has shown much promise in reducing the scrap rate on difficult castings, increasing the density of castings, allowing thinner walls to be cast, and in the production of better surface finish on the castings.

It is not recommended for all aluminum castings and is not a cure all. The dies must still be properly designed, must be gated and risered correctly, the proper lubricant must be used and, in general, good die casting practice followed in every respect. Vents can be eliminated and, in many cases, overflows are not necessary.

3. MAIN VACUUM CONNECTION on a cold chamber machine.

4. THE TWO SOLENOID VALVES evacuate through the shot cylinder and the ejector box. The machine cycle controls both valves.

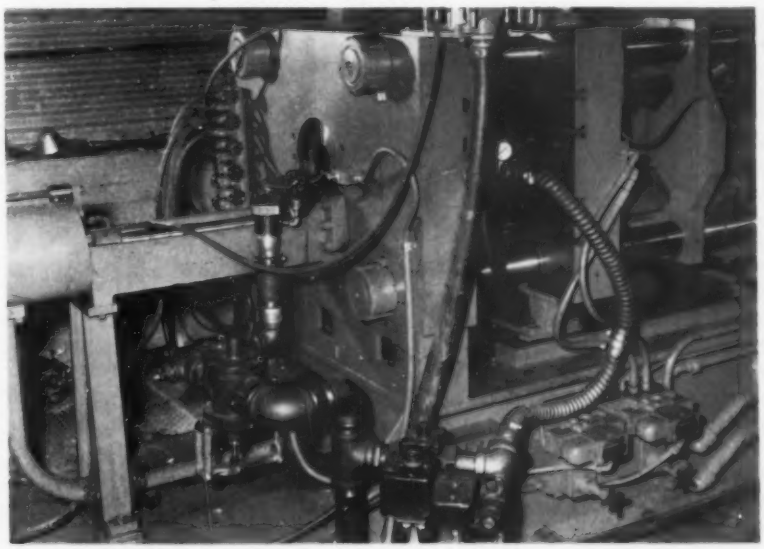


photo courtesy Stauffer Chemical Co.

COLUMBIUM METAL bars being melted in an electron beam furnace.

Ultra high-purity metals produced by . . .

Electron Beam Melting

A NEW melting and casting process, which uses electron bombardment in a high vacuum, promises to extend the use of some special metals, such as beryllium, zirconium, tantalum, tungsten, molybdenum and columbium. The process will make these metals available, for the first time, in semi-commercial quantities at high purity (in some cases higher than had ever been achieved before) and at a considerably lower cost. Also it will permit the recycling of scrap, an important saving considering the high price of many of these metals.

The process differs from the older vacuum arc melting method in several important ways. The heating mechanism is a high-voltage electron bombardment, in which an electron gun serves as the cathode and the melt stock as the anode. The level of vacuum is also much higher, being in the range of .01 to 0.1 microns rather than 10 to 100 microns.

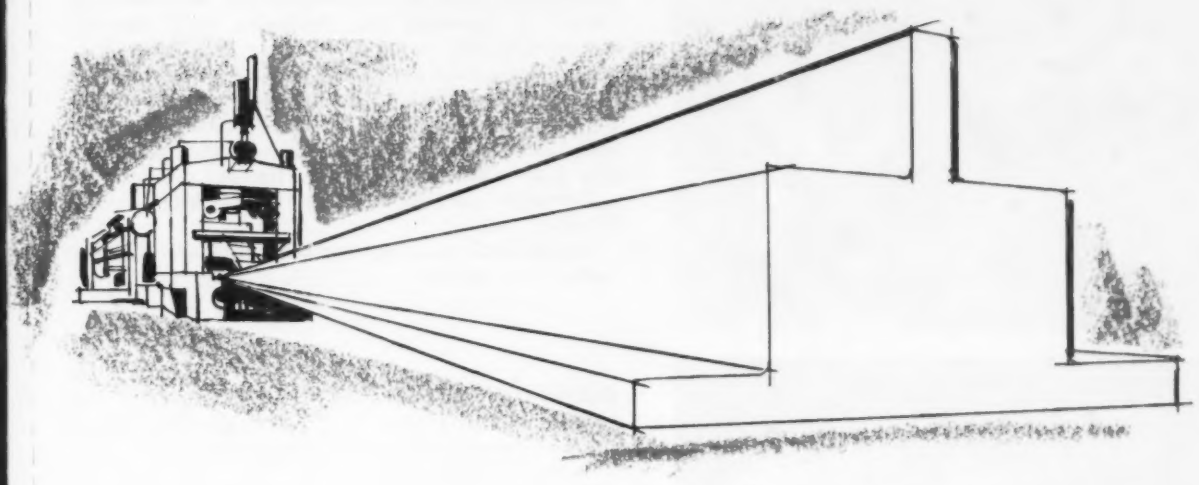
Under these conditions the electron beam heats the metal to the melting point, causing it to drip into a water-cooled copper crucible. Further electron bombardment in the crucible maintains a molten pool. The surface of the pool is kept at a constant level while the solidified ingot is withdrawn downward.

Unlike vacuum arc melting, the electron beam method can be stopped and started at any time. Many times, in vacuum arc work, valuable ingots were lost because it was impossible to stop the process when something went wrong. Another advantage the electron beam method has is that material can be melted in any form (ingot, powder, flake or sponge) whereas the arc process requires compacted material.

When used for zone refining of highly reactive metals, there is no apparent limitation on the diameter of the bar or ingot that can be processed. This allows high purity material to be turned out faster and cheaper than with conventional methods which could only handle small quantities at a time.

The economics of using electron bombardment melting are further enhanced by the fact that high voltage d.c. electrons are now relatively cheap and power efficiencies are high. Whereas solid state sintering of tantalum, for example, requires 500 KWH per pound, electron beam purification only uses 6 to 8 KWH per pound.

But more important to people in the metals industry than the economics of the situation are the new possibilities. A generally higher level of purity is now available in many of the special metals. Some metals, such as ductile columbium, heretofore only a laboratory curiosity, are now commercially available. Principal electron beam furnace applications are expected to be on columbium, tantalum, molybdenum, beryllium, tungsten, vanadium and special stainless steel alloys.



Cut your product costs with extruded sections, Here are examples of . . .

Who Uses Extrusions

BECAUSE almost any metal or alloy can be extruded, a potential use for extrusions exists wherever metal shapes are used. Of course, some shapes just can't be extruded, at least not economically. Also some extrudable shapes are used in such limited quantities that, again, extrusions are not economical. But the designer or production man who knows that shaped metal parts will be used in even moderate numbers should take a good look at extrusions as a possible money saving method of fabrication.

When compared with most metal forming tools, dies for extrusion are quite inexpensive. For example, tooling for extruding aluminum in sections that are solid and can be held within a 6" diameter circumscribing circle may cost as little as $100. As sections grow more complex and sizes larger the cost of tooling goes up.

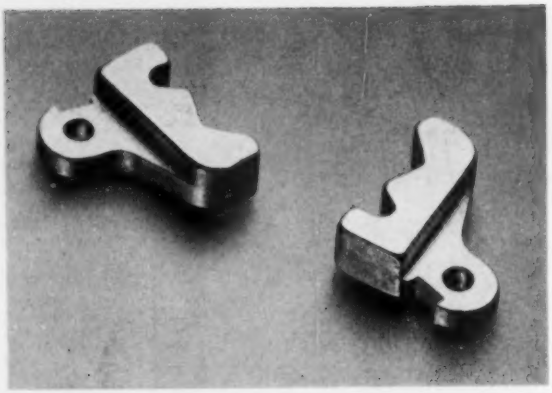
Another advantage is the speed with which tooling in the presses can be changed. Again in the smaller sizes, die change may be only a matter of minutes. This translates into exceptionally low set-up charges. And because of the fast tooling change possible in the extrusion presses it is possible for the custom extruded to run short orders, often as little as 50 pounds, without having to charge large penalties.

When you look at a part as a possible extrusion, don't forget to also consider assemblies as a whole. In many cases it is possible to extrude a single shape that replaces a number of separately formed parts which must be joined together.

Then there's the matter of finishing. Extruded sections are normally made with a fine surface finish. In many cases this surface is fully adequate for final surface finishing without any pre-treatment such as sanding, buffing or polishing.

The present users of extrusions reads like a directory of industry. There is probably no industry group which manufactures an end product that does not use extrusions. But only a start has been made. Limitless possibilities are ahead if designers will utilize a bit more imagination and more importantly, will use the freely available services of the custom extruders. These men who make a living by pushing hot metal through a die can frequently see applications that escape a less critical eye. What's more, they'll save you money by advice on design. Simple design changes which mean nothing as far as part function is concerned will often mean far less costly tools and lower cost extruded sections.

On the following pages just a few of the many thousands of applications of extruded sections are shown and described. They are intended to give the designer an idea of what can be done. In no way do the parts shown limit design availability.

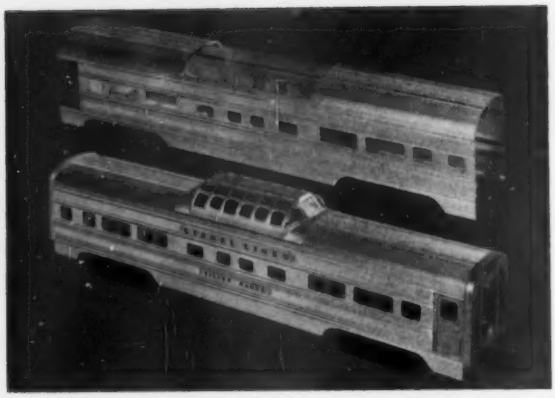


LOCKING ARM for combination pad lock made by Sargent & Greenleaf, Inc., Rochester, N. Y. Part designed originally as an extrusion.

Material – AISI 1117 steel. Second operations after cut-off from extruded bar are mill clearance, drill hole, countersink both sides, mill clearance for pin, mill slot, surface grind flat sides, deburr, degrease, zinc plate and chromate coat (Irridite).

Extrusions are supplied by Utility Mfg. Co. of Waltham, Mass.

No estimates of saving over other methods of manufacture are available.



BODY FOR MODEL PASSENGER CAR made by The Lionel Corp., Irvington, N. J. Part originally made as metal stampings and molded plastic parts.

Material – aluminum.

Second operations are only to cut-off and pierce.

This extrusion is an original design.

Surface finishing is to electro-chemically clean and polish then partially paint, depending on the design requirements.

Extrusions made by the Aluminum Co. of America.

The use of extruded sections does not show any cost saving, but does give a better quality part than was formerly secured.

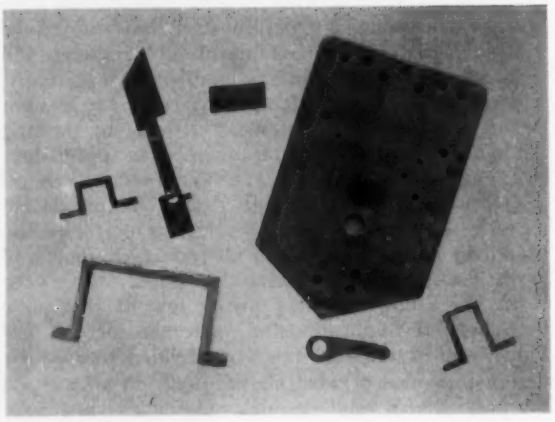
PAWLS FOR CLUTCH in forward and reverse mechanism of turret lathes made by Jones & Lamson Machine Co., Springfield, Vt.

Material – SAE 8615 or 8715 steel.

Parts were formerly machined from rectangular bar stock of the same composition. Now cut off from extruded shape and surface ground. Use of an extrusion eliminated plain and profile milling.

Saving in machining cost 63%, set-up time reduced by 2 hours, 22 minutes and actual machining time reduced by 24 minutes per piece. Scrap losses about ½ ounce with extrusion, 6½ ounces with bar stock. Overall saving about 33%.

Extrusions made by Jones & Laughlin Steel Corp.



COIN OPERATED LOCKS made by Nik-O-Loc Co., Indianapolis, Ind. Seven different parts are made from brass extrusions. All parts were formerly made as brass castings, all are original extrusion designs. Except in isolated cases, machine operations are limited to cut-off to length from the extruded bar, drilling and tapping. In one or two cases minor milling is also needed.

Extrusions are made for the Nik-O-Lock Co. by the American Brass Co.

Surface finishing is only to grind and polish.

For all seven parts the estimated saving through the use of extrusions is 50%.

FRAMING MEMBERS and supports used in a white print machine made by Peck & Harvey Mfg. Corp., Chicago.

Material – aluminum.

These parts represent original design for extrusions. Originally the channel members used were stock items, but later design made the use of a specially designed channel desirable. The angle members are standard stock items.

Second operations are cut-off, drilling and tapping only.

The estimated saving through the use of extrusions in this equipment is about 30%.

Extrusions are furnished by Korhumel Steel.

CAMERA BED EXTENSION for the Triamparo Camera made by L. F. Deardorff & Sons, Chicago.

Material – 17ST Aluminum.

The extrusion replaces a sand casting of 195-T6 formerly used. Previous machining operations were: Straighten, grind bottom flat on abrasive disc, mill top surface and cut dove tail, mill outside parallel to inside, take finishing cut on bottom. Fit two sliding pieces individually.

Now the machining is to cut-off to length and machine dovetail with a fly-cutter then mill out center section to lower weight.

Estimated saving with own design more than 80%.

Extrusion furnished by Aluminum Co. of America.

STOCK EXTRUSIONS for frame members and legs of corn popper and screening box made by Long Eakins Co., Springfield, Ohio.

Material – aluminum.

These extruded angles replace stamped steel legs on the popper and structural steel angles on the screening box.

Second operations are: cut to length, notch angles to fit screening box. Drill and tap where needed.

The saving realized by the conversion is from 25% to 50%.

The aluminum extrusions are furnished from warehouse stock by Williams & Co.

SPLIT CLAMP RINGS with a 158° toothed section are produced from extruded stock by American Bosch Arma Corp., of Springfield, Mass.

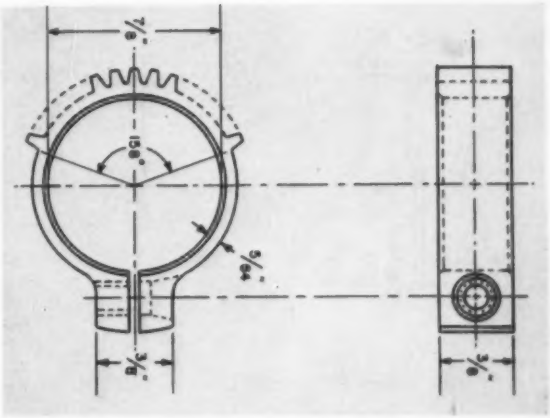
Material – AISI type C1144 steel.

A solid extrusion with the desired outside shape, but without the teeth is produced. Second operations are then to drill center hole, cut teeth, mill slot, drill lockscrew hole and tap on one side.

The rings are stronger than those previously machined from 1½" round bar stock of AISI type C1118 steel. Machining time has been reduced 22% and an overall cost saving of 18%.

The steel extrusions are furnished by the Jones & Laughlin Steel Corp.

more examples on page 36



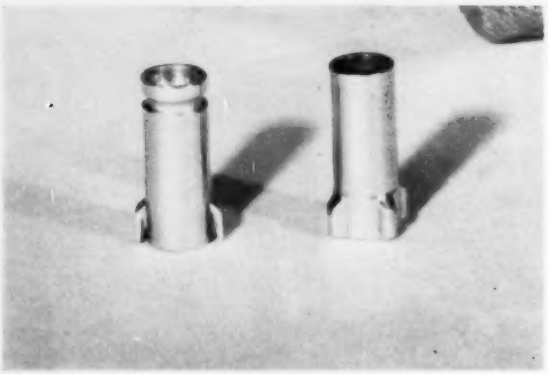
DESK TOP EDGING that conforms closely to the rounded corners on desks and tables and holds a rubber bumper strip is produced as an extrusion for All-Steel Equipment, Inc., of Aurora, Ill.

Material – 635-T5 aluminum.

The extruded aluminum has proven more satisfactory than either rolled stainless steel strip or plastic edging. The aluminum conforms to the top contour better than other materials, does not buckle due to differential expansion when temperatures change and can be purchased in lengths which eliminate any scrap from "tag" ends.

Second operations only to punch screw holes on 5" centers and apply, corners are bent by hand.

Production has increased 25%.

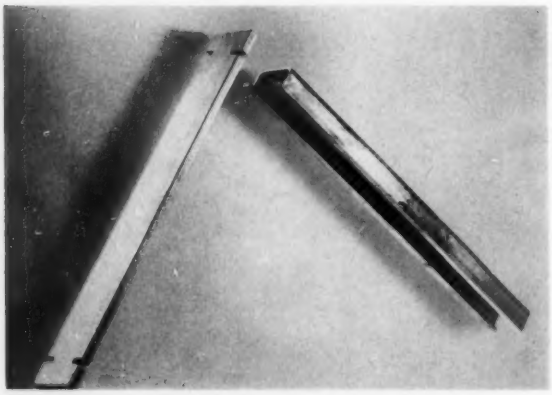


TAKE-UP SPINDLE for an 8 mm movie camera used to be fabricated from 0.281" diameter steel tubing with a 0.049" wall. By converting to an extruded brass section five machine operations were eliminated and manufacturing time cut over 60%. While the cost of stock for the extrusion is somewhat higher than the steel, the net cost reduction has been over 50%.

Finishing is to plate with copper and then bright nickel. Barrel plating is done on these parts.

The use of the extruded section also permitted some desirable design changes that could not be incorporated in the older steel part.

Bell and Howell uses the extrusion.

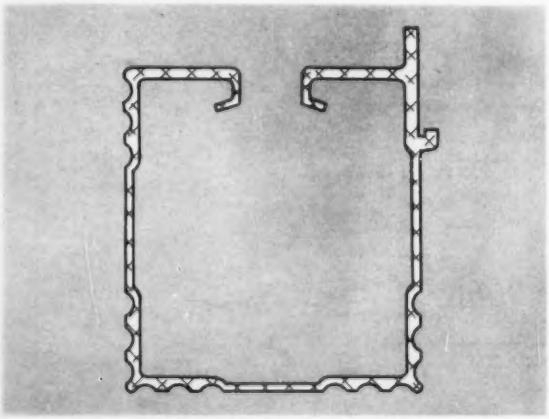


FOCAL PLANE TILT adjustment on a portrait camera, redesigned to allow two movements independently of each other. An older design did not permit the individual adjustment. Swing of the front moves in a slotted plate while vertical movement is by a rack and pinion held in place by the brass extrusion.

The channel is cut-off 5¾" long and silver soldered to the base.

Cost saving in this item is unimportant since the redesign was entirely for functional purposes.

Finish of the extrusion is polished nickel plate.

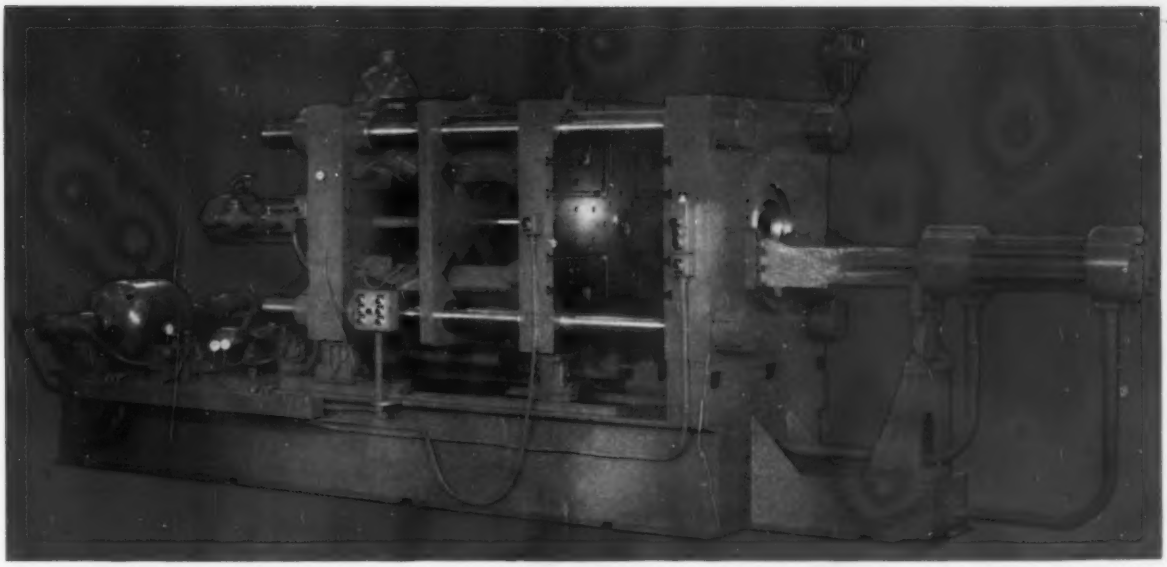


PORTRAIT CAMERA UPRIGHT SUPPORT redesigned as an aluminum extrusion from a fabricated steel post.

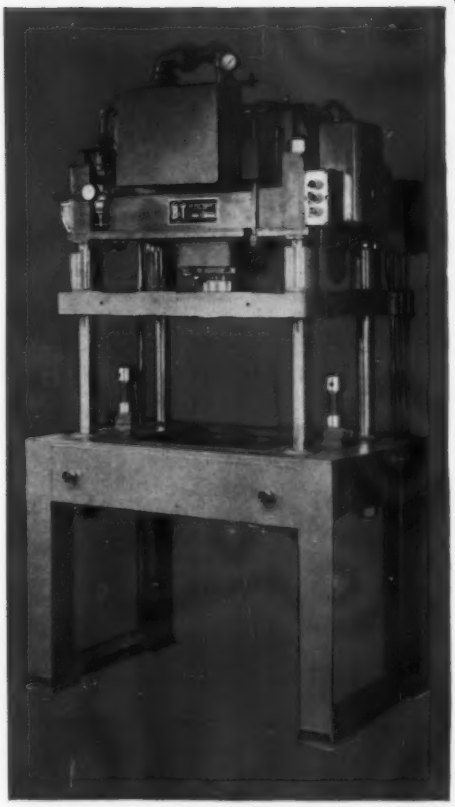
Cost saving, in this case, was far less important than uniformity from piece to piece and appearance.

Previously each upright was formed on a press brake. The steel was difficult to work with and sizes varied so much that each piece had to be treated as a custom made job. One-sixteenth inch thick steel was used.

The columns are now extruded in aluminum with an average wall of ¼". The columns are cut-off, the end machined, and six holes drilled. Finish is paint.



*A Winning Combination!



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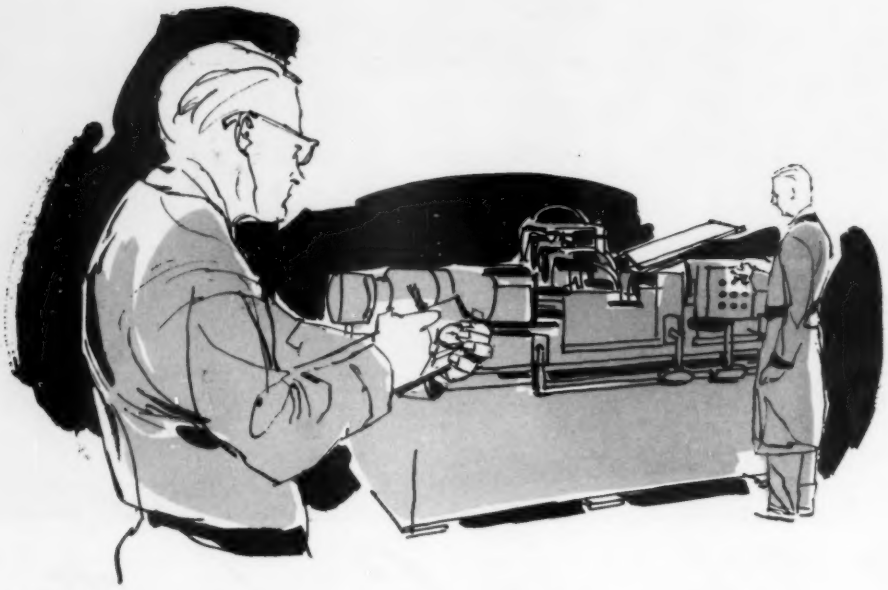


Why Use Magnesium Castings?

More parts per pound, lower machining costs, lower shipping charges.

THE favorable weight to strength ratio of magnesium is well known and has been the basis for many of the applications of this metal. Almost as well known is the favorable cost per unit volume of magnesium which makes this metal competitive with aluminum in many cases.

Less well known are some of the other advantages of magnesium which could influence materials selection if they were more carefully evaluated. What are some of these advantages? Mostly they have to do with the lower cost machining of magnesium as compared with other metals that are commonly cast or extruded. A further advantage that is often overlooked is the lower shipping costs for parts of comparable volume. These points are worth careful examination.

MACHINING COSTS

The relative machinability of metals has a very great bearing on the cost of finished parts. Table I lists machinability as the relative power required to machine equal amounts of metal.

The relative rates of machining for different standard operations are given in the following tables. Note that in all cases magnesium alloys are, by far, the easiest to machine, this always translates into lower machining costs.

These lower machining costs are most clearly shown in the case of two typical parts converted from cast iron to magnesium castings.

Case I
MAGNESIUM vs CAST IRON PULLEY

	Machining Time	
	Cast Iron 32 lbs.	Magnesium 8 lbs.
1st operation	46 min.	15 min.
2nd operation	10 min.	4 min.
3rd operation	8 min.	5 min.
Balancing	5 min.	not required
Total	69 min.	24 min.
Shop rate $5.00 per hour		
Machining costs	$5.75	$2.00

Saving per pulley through the use of magnesium $3.75
Note that on this machining operation only one lathe is needed when machining magnesium while three lathes are needed when machining cast-iron. This can represent a material saving in capital investment for tools.

SHIPPING COSTS

Earlier mention was made of the saving possible through reduced

Case II

MAGNESIUM vs CAST IRON OIL FILTER PART

	Cast Iron	Magnesium
Casting Cost	$0.64	$1.03
Machining cost	0.62	.12
Total cost	1.26	1.15

Saving through the use of magnesium $0.11 per piece. On a production run estimated at 700,000 pieces the saving is $77,000.00. This does not include unknown savings in shipping costs.

shipping charges when parts are converted to magnesium. An example is an automotive fuel pump. This unit is normally die cast in either zinc or aluminum. A switch to a magnesium die casting showed the saving in shipping charges listed in Table VI.

Not all of the savings can be realized on every part. The tables show, however, that costs must always be compared at the same level of completion; otherwise an entirely false picture will be secured.

Table I

RELATIVE MACHINABILITY OF METALS

Metal	Relative Power
Magnesium Alloys	1.0
Aluminum Alloys	1.8
Brass	2.3
Cast Iron	3.5
Mild Steel	6.3
Nickel Alloys	10.0

Table II

TAPPING

Metal	Speed - s.f.p.m.
Magnesium	75 to 200
Aluminum	50 to 100
Zinc	50 to 100
Steel	40 to 70
Cast Iron	70 to 90

(The material for this article was taken from a paper "Economics of Magnesium for Various Applications" by Ralph G. Gillespie, Brooks & Perkins, Inc. presented at the 14th annual meeting of The Magnesium Association).

Table III

LATHE MACHINING

Metal	Speed - s.f.p.m.	Feed - in./rev.	Depth of cut
Magnesium	1000 and up	.005" to .100"	½" max
Aluminum	600 to 1000	.005 to .030	¼" max
Zinc	250 to 600	.005 to .060	¼" max
Steel	50 to 200	.005 to .080	¼" max
Cast Iron	50 to 120	.005 to .080	¼" max

Table IV

DRILLING (high speed steel tool)

Metal	Speed - s.f.p.m.	Feed - in./rev.
Magnesium	300 to 2000	.004 to .030
Aluminum	300 to 550	.004 to .016
Zinc	100 to 300	.002 to .010
Steel	25 to 75	.002 to .010
Cast Iron	10 to 70	.002 to .010

Table V

MILLING (high speed steel tools)

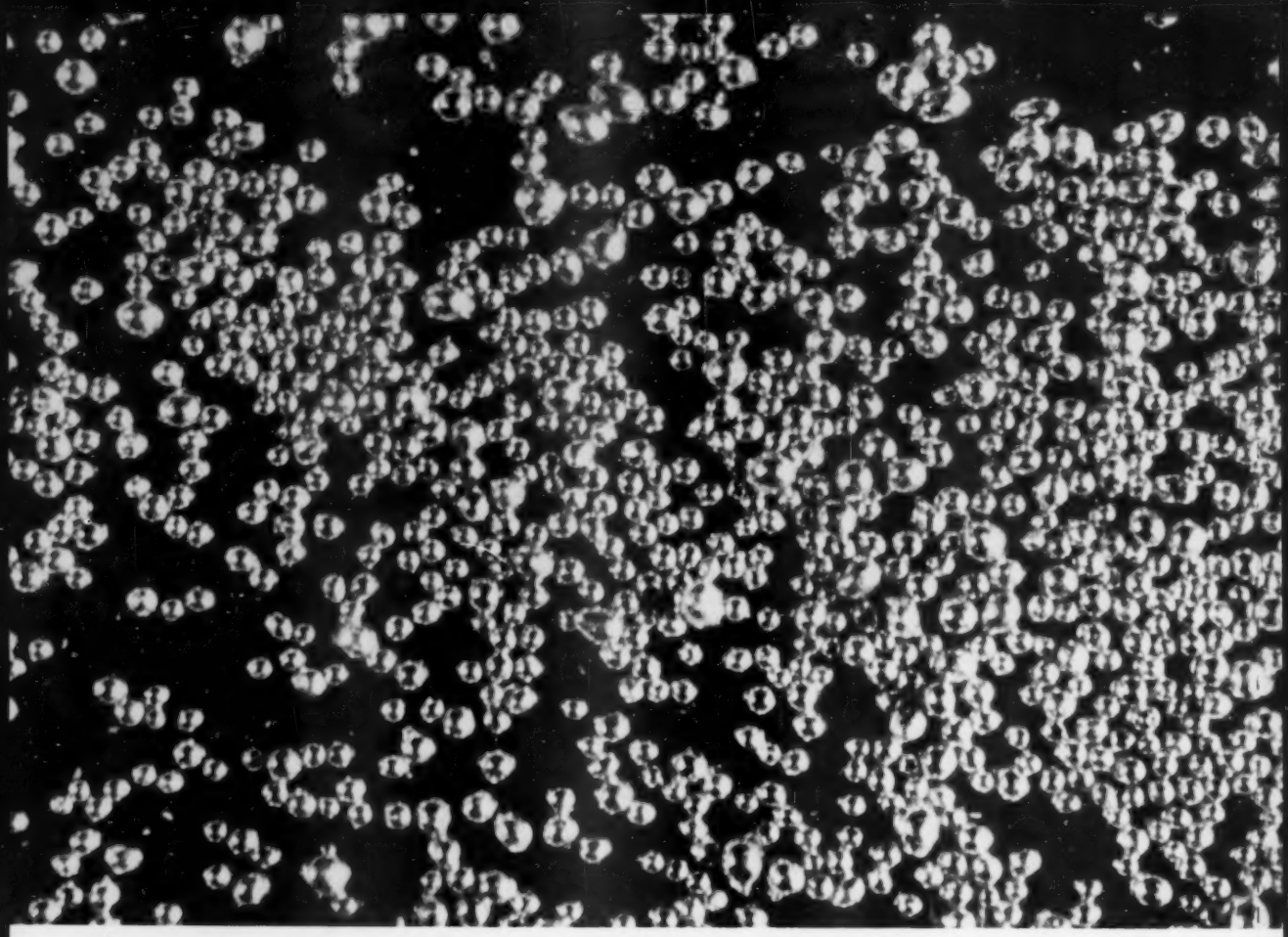
Metal	Speed - s.f.p.m.	Feed - in./min.	Depth of cut = in.
Magnesium	1000 and up	10 to 100	.50 max.
Aluminum	400 to 800	3 to 40	.25 max.
Zinc	250 to 400	2 to 30	.062 max.
Steel	40 to 100	1 to 2	.25 max.
Cast Iron	50 to 120	.5 to 2	.25 max.

Table VI

SHIPPING CHARGES ON FUEL PUMPS

(Michigan to Los Angeles)

Number of Pumps shipped	By truck	By Rail	Saving per unit through use of magnesium
1,000			
Zinc	$ 235.68	$ 245.24	$0.176
Aluminum	88.38	91.89	0.029
Magnesium	58.92	61.26	
5,000			
Zinc	1,178.40	1,225.20	0.176
Aluminum	441.90	459.45	0.029
Magnesium	294.60	306.30	
10,000			
Zinc	1,411.20	2,450.40	0.081
Aluminum	883.80	918.90	0.029
Magnesium	589.20	612.60	
100,000			
Zinc	14,112.00	9,144.00	0.063
Aluminum	5,292.00	3,429.00	0.006
Magnesium	3,528.00	2,886.00	



1. SPHERICAL PARTICLES of type 316 stainless steel powder produced by the most efficient atomization process.

If your product needs them, here are . . .

DESIGN FOR SINTERINGS

Custom Atomized Metal Powders

by GORDON J. LeBRASSE*
ROBERT L. PROBST**

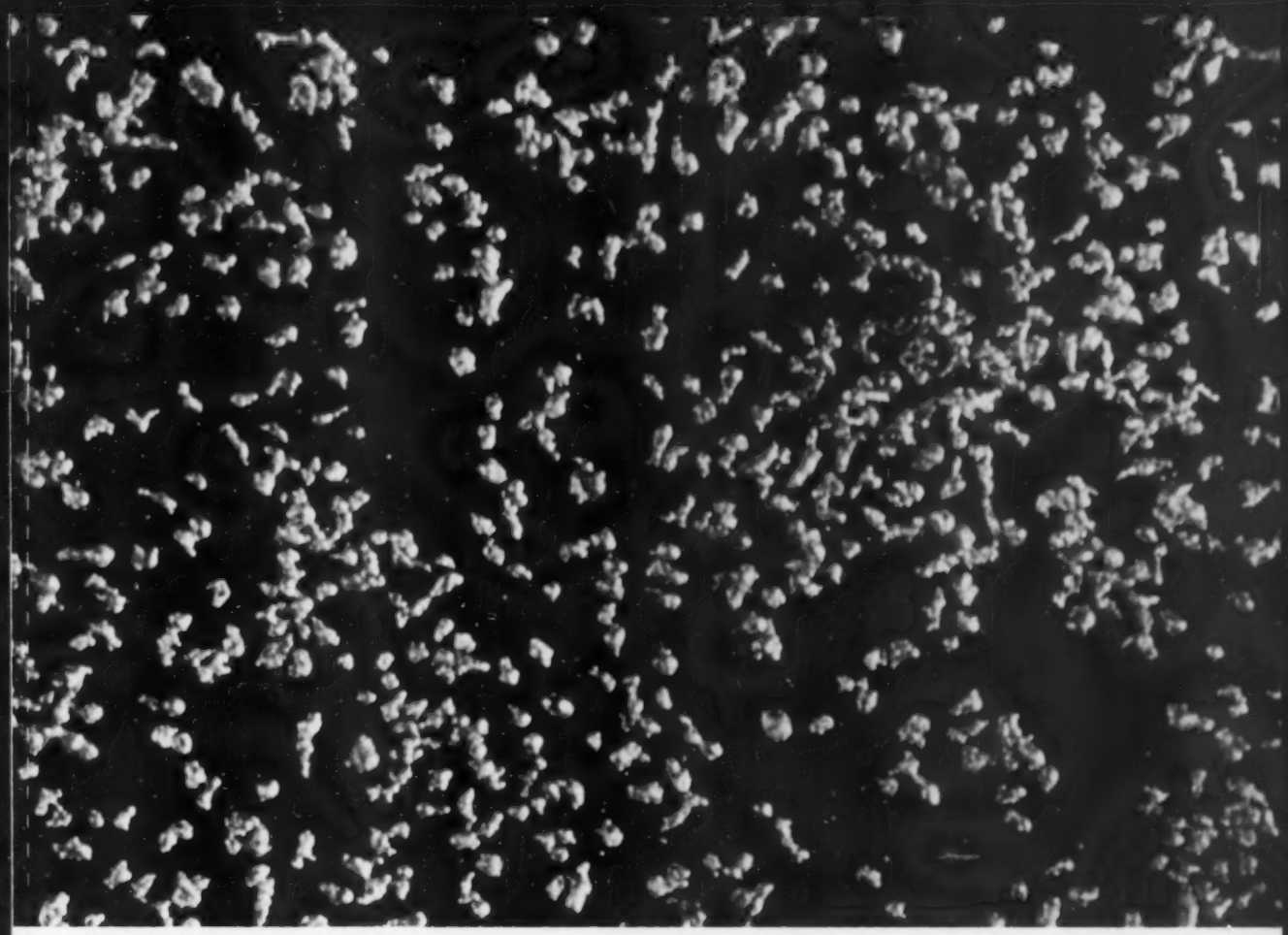
WHEN functional properties call for special materials, many designers and production men turn to sinterings as the only means of getting what they want. Flexible though powder metallurgy is, there are many cases when available metal powders will not give the desired end product.

Federal-Mogul Division has been investigating and developing methods of metal atomization for the past 15-20 years. In recent years methods of atomization high temperature alloys of exceptional purity, low oxide content and controlled particle size and shape have been developed. These powders are finding wide use in such diverse applications as high temperature brazing in jet engine and rocket component parts, special corrosion resistant filters, new slip casting techniques for complex and intricate shapes, oxide dispersion hardening, porous media for sweat cooled applications, reactor fuel elements, etc.

By the utilization of early techniques of atomization used in producing copper-base alloy metal powders, which have been and are currently used in the production manufacturing of automotive bearings, bushings and washers, modifications and new techniques have been developed through intensive research which are capable of producing exceptionally clean and fine metal powders of pure metal or alloy compositions which have been unobtainable.

Specifically, clean and fine metal powders of the 18-8 stainless steel (300 Series) compositions were developed, manufactured and used in the fabrication of transpiration cooled turbine rotor blades under

*DIRECTOR OF RESEARCH
**RESEARCH METALLURGIST
FEDERAL-MOGUL DIV., FEDERAL-MOGUL-BOWER BEARINGS, INC.



2. IRREGULAR SHAPED particles of type 316 stainless steel powder produced by varying the degree of efficiency of atomization.

contract work sponsored by the Bureau of Aeronautics, United States Navy Department.

Stainless steel metal powders of the 400 series were manufactured and used in experimental research studies.

The above stainless steel compositions have been used by filter manufacturers for high grade corrosion resistant filter applications.

Recent experimental research studies by Dr. H. H. Hausner[1] utilizing 316 Type stainless steel alloy metal powders in newly developed slip-casting techniques have produced phenomenal results in physical and mechanical properties of intricate shapes and designs without the use of high-cost, multiple action dies for compacting.

Pure precious metals such as silver and alloys thereof have also been made into fine, clean metal powders.

Metal alloy powders of various high temperature brazing alloy compositions, such as manganese-nickel, manganese-nickel-chromium, etc., have been manufactured by this atomization process for prominent brazing alloy companies and A. E. C. sponsored work.

High temperature alloy compositions such as cobalt-chromium (80-20) have been atomized into clean, fine alloy metal powders for experimental research at the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics.

Also, high temperature alloys, such as Udimet 500, have been atomized into alloy metal powder for experimental investigation by a manufacturer of jet engines.

Nickel-chromium (80-20) alloy has been atomized into clean, fine alloy metal powder with the specific purpose being to obtain the largest possible quantity of powder 10 microns and smaller. This material is planned for experimental studies in oxide dispersion hardening of alloy systems.

The production of these pure metal and alloy compositions into clean, fine metal powders is accomplished by basically obtaining the maximum efficiency from the atomization process.

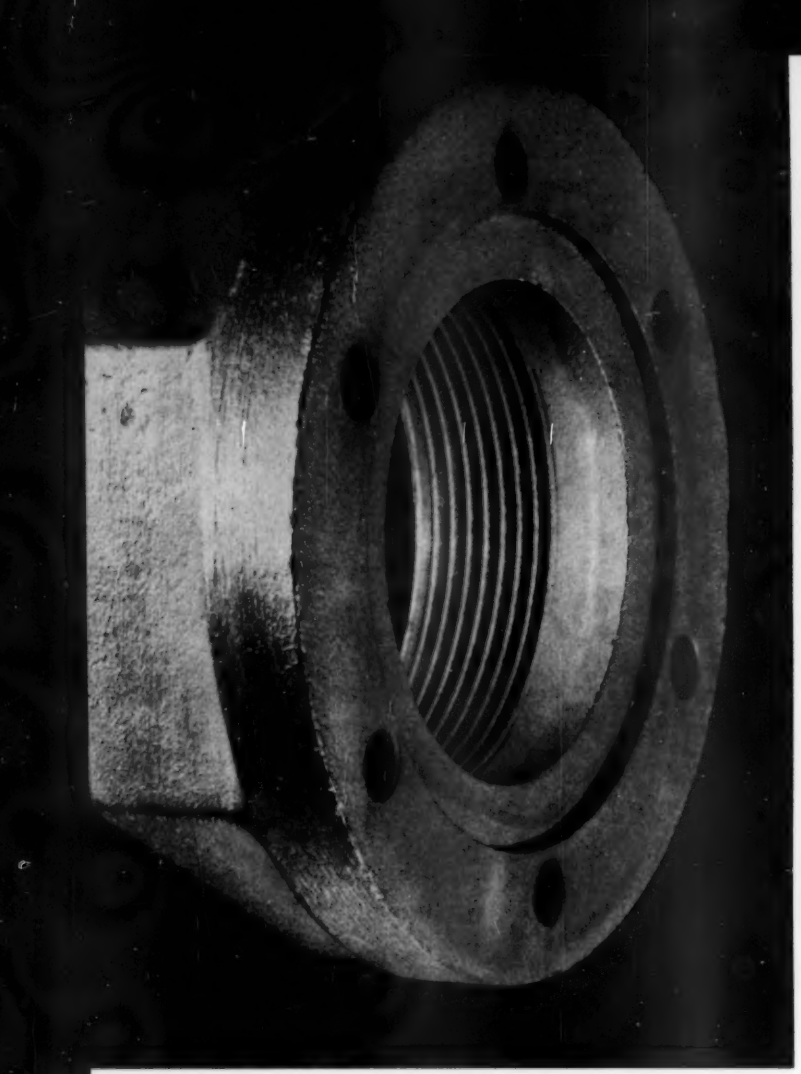
One enhancing feature of this process, in its present stage, is that small heats (as little as 5 to 10 pounds) can be experimentally produced at nominal cost to investigators who are interested in special and novel applications utilizing clean, fine metal powders in powder metallurgy processes.

A typical example of the spherical particle shape obtained by this atomization process can be seen in Figure 1, of Type 316 stainless steel.

The same alloy is shown in Figure 2 having an irregular particle shape which is obtained by varying the degree of efficiency of atomization.

The future of metallic powders is dependent upon the increased usage through increased applications. This process of efficient atomization is making available powder metals of compositions

continued on page 55



DESIGN FOR
SHELL MOLD CASTINGS

60% CUT IN MACHINING TIME resulted when green sand castings were eliminated and shell mold castings used.

By changing to a shell mold casting, you can . . .

Cut Machining Time - Cut Costs

A COMPANION pipe flange is a common-place item. It's generally a sand casting on which only minor machining has to be done. For low pressure service where there is no corrosion cast iron with a 35,000 psi tensile strength is plenty good enough.

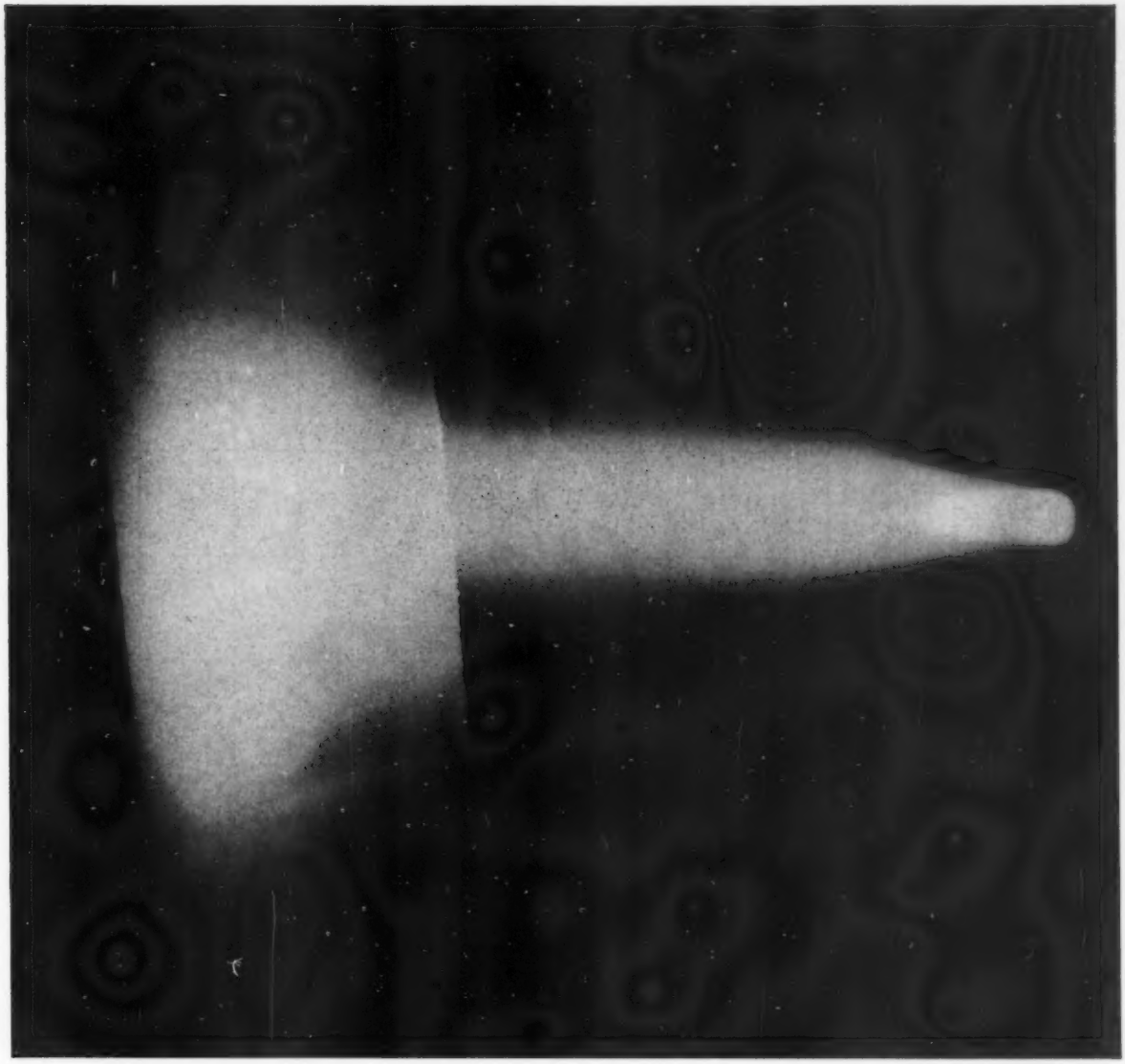
But let's look at this simple job. What's involved after a pile of rough castings are dumped on the receiving dock. After incoming inspection the rough castings go to the machining floor. Here a special set-up had to be made because the dimensions of the parts varied so that high speed chucking couldn't be done. The actual machining operations were:

1. Cut a sealing flange ⅛" deep x ½" wide on the face.
2. Remove flange from the machine and turn it around.
3. Bore center hole to size.
4. Taper ream center hole.
5. Cut pipe thread on inside of hole.
6. Drill and tap six 7/16" bolt holes.

Now compare this machining with the work on a shell mold casting. Here are the steps.

1. Tap center hole.
2. Drill and tap six 7/16" bolt holes.

Not much doubt about which is the better. With sand castings it used to take 15 minutes to machine a flange. Now it's done in 6 minutes. But that isn't the only saving. Because a special set-up was needed it wasn't economical to machine less than 1000 flanges at a time. That was an average year's supply. Now, with no special jigs or fixtures, a three jaw chuck on a lathe is all that's necessary, and lots of 100 flanges are economically handled.



INCO-CAST... because it's a high temperature "problem" casting

It's no cinch to cast a hollow air foil shape like this in a special high temperature alloy.

It takes a foundry that makes this specialized work its standard business... one that knows both aircraft engine requirements and the high temperature alloys that meet them.

In a word... Inco. Inco is experienced in casting high temperature alloys for aircraft engine parts... has a name and a reputation for quality. And Inco has a name and reputation for research in high temperature alloy metallurgy.

That's why the turbine vane shown is an Inco production item. When you need parts like it, call in Inco. You'll be glad you did.

The International Nickel Company, Inc.
Bayonne Works • 15 Oak St. • Bayonne, N. J.

INCO

100% go-no go inspection in a jig like this is just one of many ways Inco makes *certain* that vanes for aircraft turbines meet requirements. Other available non-destructive tests include Zyglo and X-ray. Many "spot" destructive inspections are also used to insure step-by-step quality control during production.

INCO-CAST PRODUCTS

For more information circle No. 31 on the Reader Service Card

PMM TECHNICAL REFERENCE FILE

PROPERTIES OF EXTRUDED ALLOYS — TABLE V

Fabricating Characteristics and Corrosion Resistance of Aluminum Extrusion Alloys

	FABRICATION(1)						CORROSION RESISTANCE(2)				AVAILABILITY		
Alloy and Temper	Cold Working	Gas Welding	Arc Welding	Resistance Spot and Seam Welding	Brazing	Machining	Rural	Outdoor Industrial	Marine	Sea Water	Extr. Simple Shapes	Extr. Hollow Shapes	Typical Applications
3003-F	A	A	A	A	A	C	A+	A	A	A	*	*	Trim molding, low stressed sections requiring best corrosion resistance and weldability.
2014-0	A	D	C	A	X	C	A	B	C	C	*		Highly stressed members requiring extensive forming, to be heat treated and aged after forming.
2014-T4	C	D	C	A	X	A	A	B	C	C	*		Highly stressed members requiring moderate forming. Can be aged after forming for maximum strength.
2014-T6	C—	D	C	A	X	A	A	B	C	C	*		Highly stressed members in aircraft and processing machinery. Minimum thickness of 14S-T6 is .125 inch.
2024-0	A	D	C	A	X	C	A	B	C	C	*		Used in place of 14S alloy where sections thinner than .125 are specified. Can be formed in 0 temper and heat treated to T4 temper or formed immediately after solution heat treatment and will age at room temperature to full strength.
2024-T4	C—	D	C	A	X	A	A	B	C	C	*		
6061-0	A	A	A	A	A	C	A	A	B	B	*	*	Sections requiring strength equal to mild steel, good machining and welding properties. 0 temper is used if part requires severe forming, to be heat treated after forming. T4 temper is used for moderate forming operations, can be aged after forming.
6061-T4	B	A	A	A	A	B	A	A	B	B	*	*	
6061-T6	B—	A	A	A	A	B	A	A	B	B	*	*	
6063-T42	B—	A	A	A	A	C	A+	A	A	A	*	*	Sections requiring moderate strength, best possible surface finish, good weldability, such as window frames, storefronts.
6063-T5	B—	A	A	A	A	B	A+	A	A	A	*	*	
6063-T6	C+	A	A	A	A	B	A+	A	A	A	*	*	Very highly stressed aircraft sections such as wing spars. Can be formed in 0 condition and heat treated after forming.
7075-0	A	D	C	B	X	C	A	B	C	C	*		
7075-T6	D	D	C	B	X	A	A	B	C	C	*		

NOTES: (1) Relative fabrication ratings indicate: 'A' excellent, 'B' good, 'C' fair, 'D' poor, 'X' cannot be brazed. (2) Ratings in all columns are interrelated. An 'A' rating is highest. Rating compares the stability of all aluminum-base alloys as a group. However, under many conditions, alloys rated 'C' are used with satisfactory results; on the other hand, alloys rated 'A' or 'B' require protection in some exposures. Rural Atmosphere: Inland and uncontaminated by smoke and fumes from industrial processes. Industrial Atmosphere: Contaminated by smoke and industrial fume. Marine Atmosphere: Frequent salt mist. Sea Water: Immersion in salt water. Pure aluminum and aluminum alloys containing magnesium, or magnesium and silicon, and not copper, as the major alloying constituents, demonstrate good resistance to corrosion by unpolluted sea water.

(Data Courtesy Reynolds Metals Co.)

PROPERTIES OF EXTRUDED ALLOYS – TABLE VI

Finishes For Aluminum Extrusions

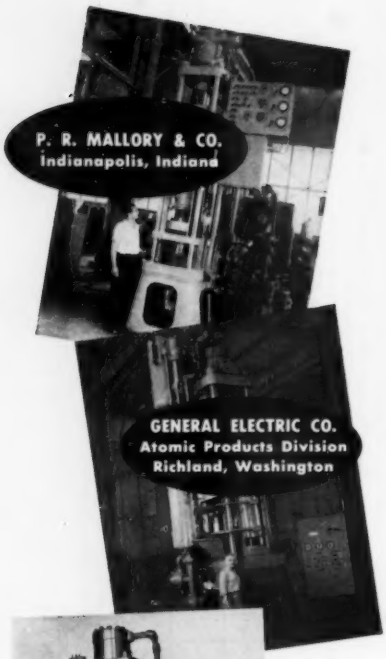
Type of Finish	*Name of Finish* [1]	*Principal Purpose of Finish*	*General Description of Treatment*
Mechanical	Grinding	To remove surface imperfections	Bonded abrasive wheel, 25 to 50 grit. Speed 8000 rpm. Grind dry or use tallow or lard oil.
	Polishing	To remove surface imperfections and to achieve decorative finish.	Steps include (1) roughing (50-100 grit), (2) greasing or oiling with soft felt wheel faced with 100-200 grit aluminum oxide and lubricant, (3) buffing, and (4) coloring, to obtain high gloss and lustre, using soft abrasives embedded in grease, muslin disks and light wheel pressure. Speeds 6000 to 8000 rpm.
	Scratch Brushing	To obtain coarse or smooth lined texture	Rotary wire brush, using stainless steel or nickel wires of 0.010" diameter. Speed 2000 rpm.
	Satin Finish	To obtain soft smooth sheen	Modification of scratch brushing. Minute parallel lines are scratched on aluminum surface. Wire diameter 0.005". Speed 2000 rpm.
	Burnishing	To impart fine finish to large number of small parts	Also called tumbling. Use rotating barrel (30 rpm), containing abrasive balls and soap solution. Time 1½ hours for medium finish, 3 hours for fine finish.
	Sandblasting	To produce uniform matte surface	Use silica sand of desired particle size. Generally, lower pressure and finer sand must be used than for heavy metals. Finish is rough and should be protected by oxide treatment or painting.
Chemical	Caustic Etch	Decorative "frosted" finish	1 minute dip in 8% caustic soda at 160° F., followed by 4 minute dip in 40% nitric acid at 70° F.
	Alrok [1]	Paint base	20 minute dip in 2% sodium carbonate—0.1% potassium dichromate at 150° F., followed by 8 minute dip in 5% potassium dichromate at 150° F.
	Bonderite [1]	Paint base	4 minute dip in 7% Bonderite 170—1% boric acid—1.5% sodium bifluoride, at 190° F., followed by one minute rinse in 0.1% Parcolene at 175° F.
	Alodine [1]	Paint base	2 minute dip in Alodine bath at 115° F., followed by ½ minute dip in Deoxylyte bath at 110° F.
	Chemical Polishing	Bright finish or base for anodizing	½ to 1 minute in nitric-phosphoric acid mixture (proprietary composition) at 240° F., usually followed by sulfuric acid dip to remove smut or discoloration.
	Phosphatizing	Paint base	5 minute dip in 8% phosphoric acid at 70° F.
	Zincate	Base for electroplating	Vapor degrease; alkali clean. Zincate bath 55% caustic soda—10% Zinc oxide, 3 minute 70° F.
Electrolytic Oxide	Alumilite [1] (Sulfuric Acid Anodize)	Hard, corrosion-resistant Oxide film	Alkali clean. Anodize 25 min. in 20% sulfuric acid, 70° F. 18 volts, 13 amps/sq. ft. Hot water seal 25 min. 190° F. If dyed coating desired: 29 min. dye bath 160° F. Seal in 1% nickel acetate, 20 min. 190° F.
	Chromic Acid Anodize	Hard, corrosion-resistant oxide film	Alkali clean. Anodize 35 min. in 8% chromic acid, 95° F. 38 volts, 2 amps/sq. ft. Hot water seal and dyeing treatment same as above.
	Alzak [1] (Electropolishing)	High light reflectivity	Alkali clean. Anodize 8 min. in 2.5% fluoboric acid, 85° F., 30 volts, 15 amps/sq. ft. Final oxidation 15 min. in 7% sulfuric acid, 70° F., 20 volts, 12 amps/sq. ft.
Electro-Plating	Chrome Plate	Abrasion-resistant and decorative finish	Prepare surface by zincating or copper plating. Chrome plate: 53 oz. chromic acid, 0.5 oz. sulfuric acid per gal. of water, 4 min. 7 volts, 210 amps/sq. ft., 125° F.
Painting	Paints, lacquers, and enamels adhere tenaciously to aluminum providing the following steps precede the final coating. (1) Clean aluminum surface by either vapor degreasing, solvent washing, or by use of acid or alkaline solution. (2) Phosphatize the surface by use of phosphoric-acid type solution. (3) Apply a zinc chromate type primer.		

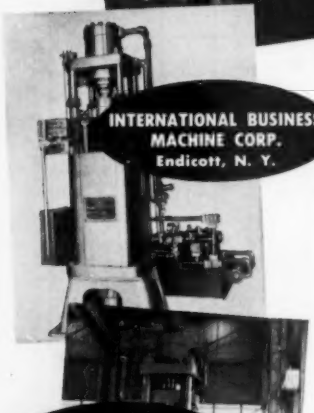
Notes: [1] The Alrok, Alumilite and Alzak treatments for aluminum are patented to Aluminum Company of America. Alodine is patented to American Chemical Paint Co. Bonderite is patented to Parker Rustproof Co.

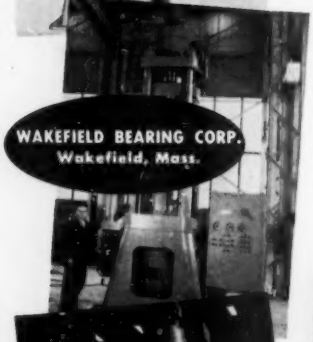
(Data Courtesy Reynolds Metals Co.)

THESE BLUE CHIP COMPANIES HAVE RECENTLY INSTALLED THE ALL-NEW KUX HYDRAULIC POWDERED METAL COMPACTING PRESSES

because:







- ✓**PUSH BUTTON CONTROL** permits simplicity and flexibility in adjusting fill, pressure, ejection, timing to suit the part being made.
- ✓**BUILT IN BALL BEARING LEADER PIN GUIDE BARS** between both the upper punch holder and the die table, and the lower punch holder and die table provide and maintain perfect tooling accuracy.
- ✓**SECONDARY LOWER PUNCH MECHANISM** for use in pressing and/or ejecting.
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- ✓**22 DESIGN INNOVATIONS** that make possible the production of the most complex parts.
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Also builders of a full range of die casting machines . . . from 25 tons to 1000 tons in size.

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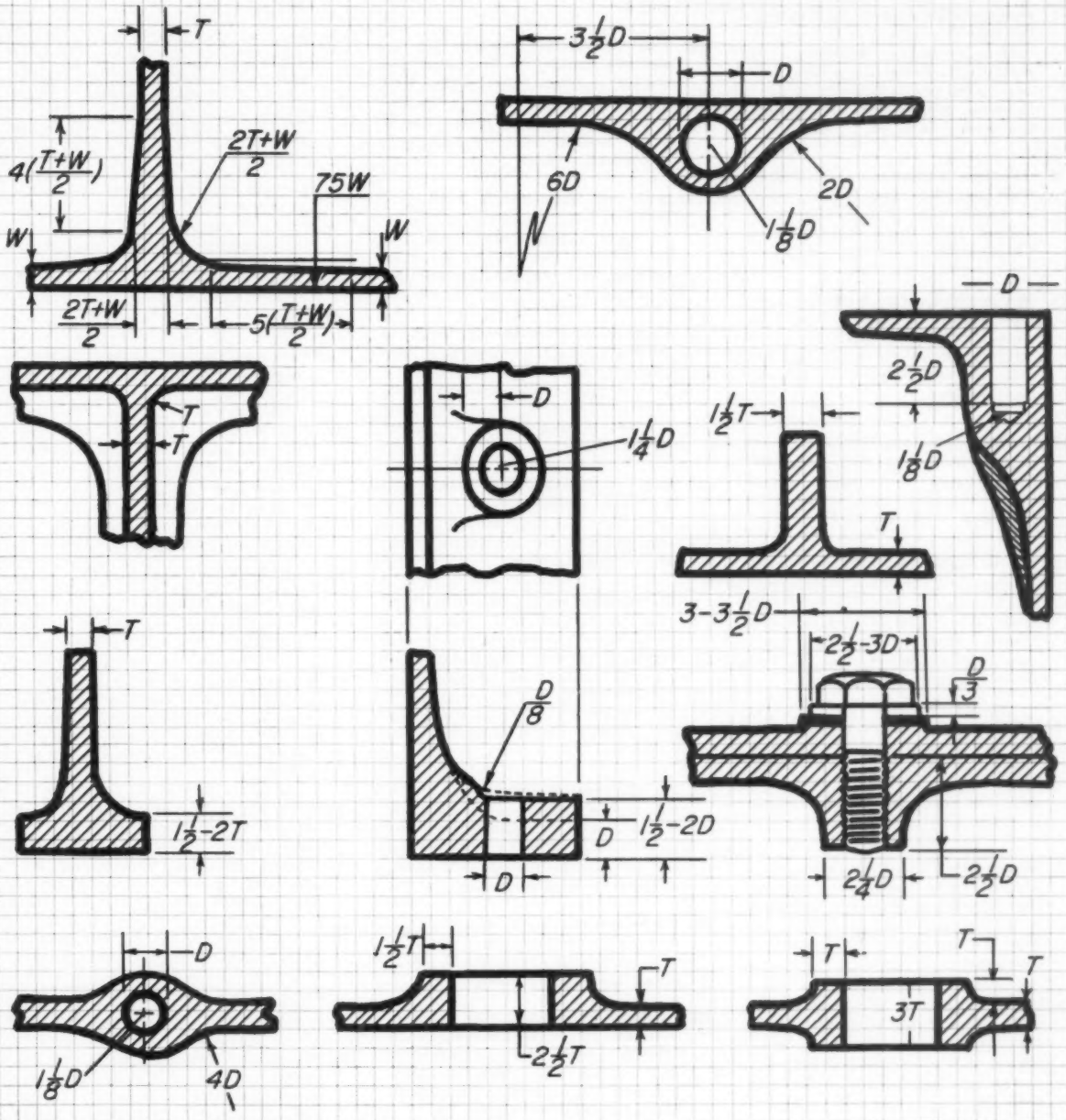
Here are some design modifications to remember when magnesium die or permanent mold castings are used

use these

Design Tips

for lower costs -better products



The modulus of elasticity is low, 6.5 x 10^6 lb/sq in. This lower rigidity is compensated for by increasing the size or number of webs, thickening walls and providing larger fillets for stressed parts. Some of the ideas above will help in designing magnesium castings.

DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards on the facing page will get you these free reference materials. Circle the numbers and mail.

3. **Publications List** — from Allegheny Ludlum Steel Corp., lists more than 125 technical publications available from the company.

6. **Hydraulic Compacting Presses** — in capacities from 2 to 75 tons, feature an exclusive shuttle-feed with rotary agitator for compacting powder metal parts. Bulletin M-11-B, Denison Engineering Div., American Brake Shoe Co.

10. **Induction Furnaces** — Equipment with capacities from a few ounces to several tons is described in literature from Ajax Electrothermic Corporation.

11. **Investment Casting Manual** — A 44-page technical manual, from Arwood Precision Casting Corp., gives information on the technique, and data that will help solve your design problems.

12. **Air-Hydraulic Trim Press** — delivers 25 tons at high cycling rates and can be moved easily from place to place. Technical data is available from B & T Machinery Co.

13. **Sintering** — The "Engineering Handbook of Powder Metallurgy", and Catalog No. 58, which lists 2,227 sizes of completely finished cast bronze and sintered oil-filled bearings, are available from Bunting Brass & Bronze Co.

16. **800 Ton.** — die casting machine will produce castings up to 20 lbs. aluminum; 46 lbs. zinc. Complete specifications and technical data is available from Cleveland Automatic Machine Co.

18. **Standardized Die Components** — which reduce design time and cut die construction costs, are described in a 170-page catalog published by The Detroit Mold Engineering Company.

19. **Die Castings** — A 16-page facilities folder is available from the Dollin Corp. on their die-casting techniques that solve rigid design requirements in zinc and aluminum castings.

22. **"Small Die Castings Exclusively"** — is the title of a new bulletin from Gries Reproducer Corp. The company's method for delivering parts of high uniformity, with close tolerances, is explained.

23. **Investment Casting** — An illustrated brochure from Hitchiner Mfg. Co. presents information on how you can utilize the freedom and savings offered with investment casting.

23. **Zinc Die Casting Facts** — Henning Bros. & Smith, Inc. has issued a booklet entitled, "Die Casting With Zinc Base Alloys". It explains factors influencing the production of sound castings and the causes of faults and defects.

29. **Induction Melting** — A technical bulletin from Inductotherm Corp., describes a completely self-contained high-frequency induction melting unit that can be installed in 2 hours.

33. **Compacting Presses** — A complete catalog is available from Kux Machinery Co. on their presses that feature push button control, positive mechanical pressure stop mechanism, secondary lower punch mechanism, etc.

34. **Induction Heating Units** — from Lepel High Frequency Laboratories, Inc., for brazing, melting, annealing, etc., are presented in an engineering catalog.

Die Casting — "Latrobe Castings" tells the story of the Latrobe reputation for workmanship, service and economy on both small and large quantity production runs. A copy of this booklet may be obtained by writing on company letterhead to: Latrobe Die Casting Co., Latrobe, Pa.

37. **Die Casting Machines** — Information on a complete line of die casting machines is available from Lester-Phoenix, Inc. The units feature reliable clamping, and are readily adapted to vacuum casting.

38. **Die Inserts** — for zinc or aluminum. A technical bulletin on Accu-Cast components for die casting is available from Manco Products, Inc.

39. **Tumbling Media** — A new abrasive that licks the barrel finishing problems of discoloration, impingement and fracturing, is presented in a technical booklet from Minnesota Mining & Mfg. Co.

42. **Split Thrust Bearings** — which save space and weight, and hold against rotation and high thrust, are described in a technical data sheet from National Molded Products, Inc.

45. **High Vacuum Pumps** — that feature clean, dry vacuum; no backstreaming; automatic operation; and no stalling from gas bursts; are described in a technical bulletin from The New York Air Brake Co.

47. **Cleans, Lubricates** — This is what the Air-Lube System, Manufactured by Pierce-Waller, Inc., does. Data folder describes this system that removes loose flash with an air blast, then lubricates mold surfaces evenly.

48. **Vacuum Die Castings** — Literature on vacuum die castings and on the Premier Die Casting Company's facilities for producing custom castings to your specifications, is available.

50. **Sintering Savings** — A brochure, "How To Cut Costs With The Remet Powdered Metal Process", is available from Reese Metal Products Corp.

51. **Powder Data** — Technical data on fatigue, impact, creep rupture, dilatometric values, electron microscope studies, and radioactive trace element tests, are given in the Republic Steel Company's progress report on their powders.

52. **Stainless Steel Ladles & Skimmers** — which are 75% lighter than cast iron and have extremely long life, are described in literature from Spincraft, Inc.

55. **Piston Lubricator** — Illustrated folder describes the Dorsey automatic piston and cylinder lubricator for aluminum cold chamber die casting machines. Westbrook Mfg. Company.

56. **Finishing Data Files** — Technical data files on Metal Finishing Processes, Equipment and Systems, and Chemicals and Supplies, are available from Allied Research Products, Inc.

57. **Barrell Finishing Handbook** — Almco, Queen Products Div., King-Seeley Corp., has issued a 52-page handbook of case history facts and descriptions of barrel finishing processes.

58. **Automatic Finishing Machines** — clamps and fixtures, mask washing machines, and spray painting masks are described in literature from Conforming Matrix Corp.

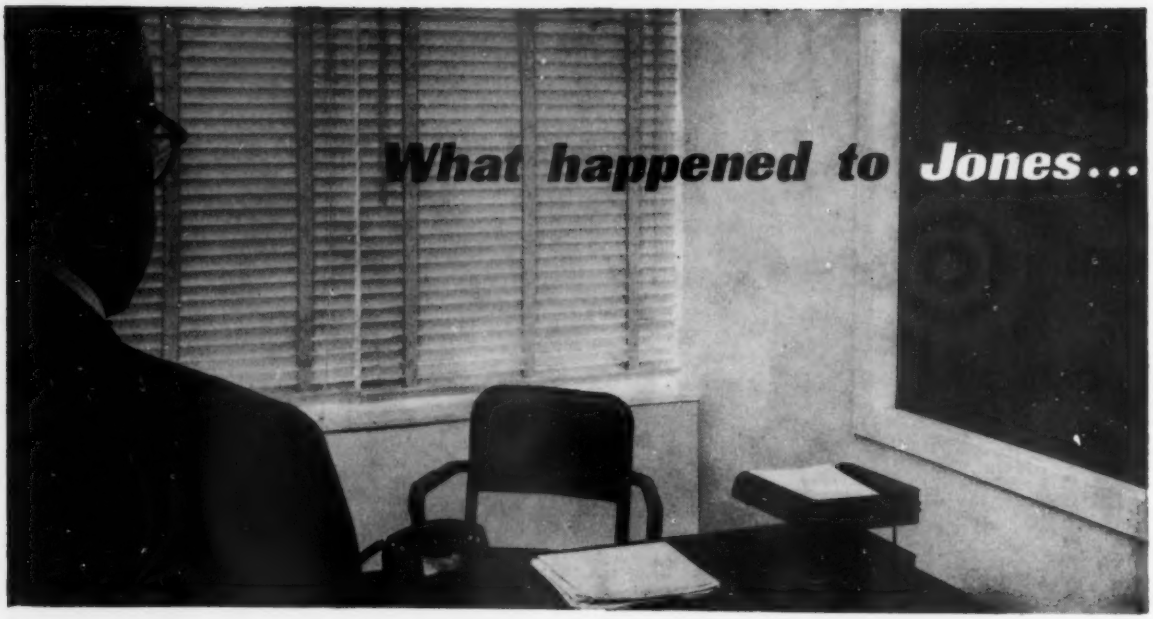
59. **Tappers** — Information is available from Errington Mechanical Laboratory, Inc., on their complete line of high speed multiple drilling and tapping attachments.

PMM

Finishing Section

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

Use barrel finishing for deburring, radiusing, cleaning & pre-plate polishing. *See Page 51.*



...could happen to any man

Jones suffered a heart attack. It happens to hundreds of thousands of Americans each year. Heart attack, or coronary artery disease, is our nation's leading single cause of death, accounting for 250,000 fatalities annually.

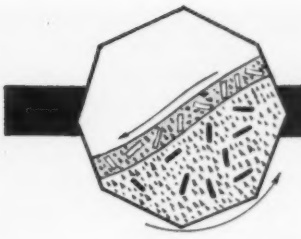
But because of new advances in diagnosis and treatment, *most victims of heart attack recover* to lead useful and productive lives.

Jones recovered and is back at his desk today, thanks to new medical knowledge developed through heart research.

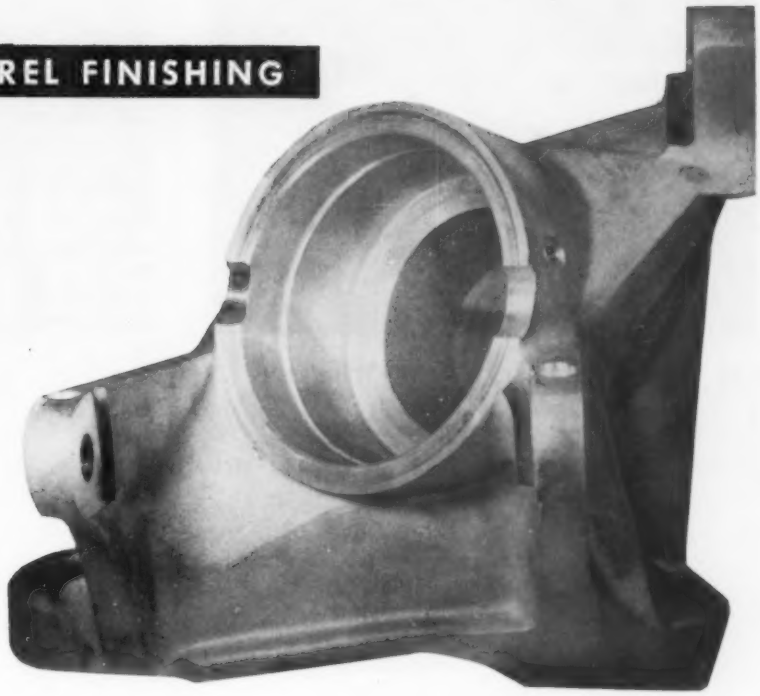
Your Heart Association, through *your* support of the Heart Fund, has allocated more than $32 million during the past ten years to research on heart and circulatory diseases. A large portion is being spent to discover the underlying causes of atherosclerosis, a form of hardening of the arteries, which is responsible for heart attack.

When you give to the Heart Fund, you are joining forces with medical science to carry forward intensive research on all forms of heart and blood vessel disease. Thus, you are making the best investment you can to safeguard *your* heart and the heart of *each member of your family.*

FIGHT HEART DISEASE ® **GIVE HEART FUND**



BARREL FINISHING



Both of these castings were . . .

Finished In A Barrel

ON the following pages you will find detailed case histories on both simple and complex parts that can be finished in a barrel. This is only a representative sampling of parts, made by the Precision Metal Molding processes, that must be mass finished to keep up with mass production. These examples are intended as a guide. Specific data varies for each part that is to be barrel finished.

WHAT IS BARREL FINISHING?

It is a precision method, for processing either large and small quantities of parts at one time. With this method you can remove burrs, sharp edges, tool marks, flash, and heat-treat scale. You can also, form small radii and prepare surfaces for the subsequent finishing operations of plating and painting. Briefly, this method eliminates completely, or reduces to a minimum, the hand finishing of each piece. It gives parts a uniformity of surface, and an appearance not obtainable with other methods.

WHAT CAN BE FINISHED?

With the proper selection of the type of abrasive media, you can successfully finish any metal part in a barrel. The softer metals, aluminum, brass, bronze, copper and zinc, can be finished in shorter cycles than the harder ferrous metals.

HOW ABOUT PART SIZE?

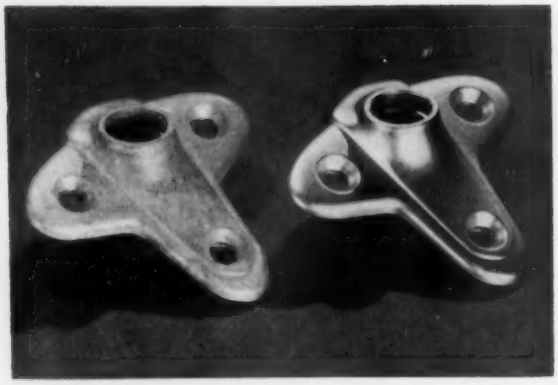
Both large and small parts can be barrel finished. The larger parts are securely fastened to racks and there is no danger of damage due to accidental bumping of the parts with each other. Both horizontal and vertical barrels are used with fixtures.

WILL I GET A GOOD FINISH?

Yes you will. A satisfactory finish for any subsequent operation, or for use as barrel finished, can be had by using the proper abrasive and compound. Depending on what you want done, and the finish you want, one, two, or more barrel finishing operations may be needed. If, for example, you want a die cast part deburred, polished and colored, you may need two separate barrel finishing operations.

In general here are the three types of finish that can be obtained. 1. A smooth finish with a low micro-inch reading. 2. A bright finish with high lustre and eye-appeal. 3. A matte finish.

continued on next page



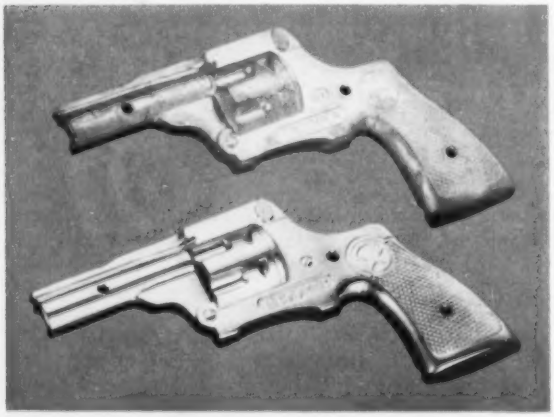
DIE CAST ZINC FACE PLATE

FINISHING NECESSARY: Clean and smooth surface for plating.
BARREL: Roto-Finish, 18″ x 24″ dia.
NO. PARTS PER LOAD: 250.
TOTAL CASTING WEIGHT PER LOAD: 25 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 250 lbs.
KIND OF MEDIA USED: Grinding.
MEDIA SIZE: #5A.
COMPOUND, KIND & AMOUNT: #260-A, 2 lbs.
WATER: 2 gal.
CYCLE LENGTH: 2 hrs.
BARREL SPEED: 12 rpm.

DIE CAST TYPEWRITER RETURN LEVER

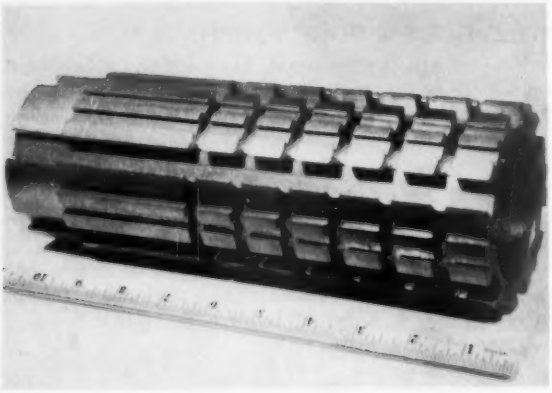
FINISHING NECESSARY: Preparation for plating.
BARREL: BMT – 12″ x 16″ dia., Sliding Honing Barrel.
NO. PARTS PER LOAD: Approximately 24.
TOTAL WEIGHT OF MEDIA PER LOAD: 80 lbs.
KIND OF MEDIA USED: Step 1 – #2 Aloxite nuggets; Step 2 – #6 Aloxite nuggets; Step 3 – #4½ Carbo Brite.
COMPOUND, KIND & AMOUNT: Step 1 – Organ TU cleaner, 2 oz. per gal. of water; Step 2 – Organ TU cleaner, 2 oz. per gal. of water; Step 3 – Organ TU cleaner, 3 oz. per gal. of water.
CYCLE LENGTH: Step 1 – 4 hr.; Step 2 – 4 hr.; Step 3 – 1 hr.

Courtesy of The Carborundum Co.



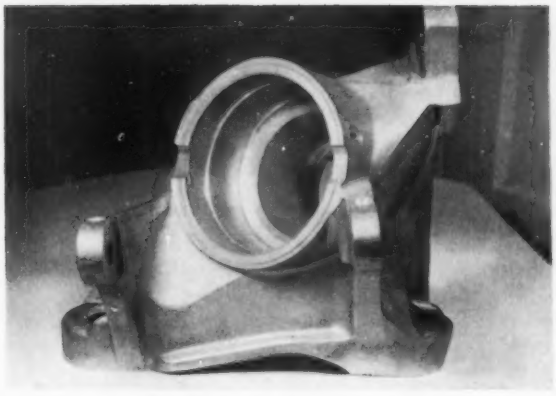
ZINC DIE CAST TOY PISTOL

FINISHING NECESSARY: Smooth, clean and brighten surface for plating.
BARREL: Roto-Finish, 30″ x 36″ dia.
NO. PARTS PER LOAD: 800.
TOTAL CASTING WEIGHT PER LOAD: 130 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 1000 lbs.
KIND OF MEDIA USED: R. F. Grinding.
MEDIA SIZE: #5A.
COMPOUND, KIND & AMOUNT: 260-A, 6 lbs.
WATER: 20 gal.
CYCLE LENGTH: 2 hr.
BARREL SPEED: 12 rpm.



STEEL PROGRAMING DRUM

FINISHING NECESSARY: Deburr, break sharp edges, improve surface finish.
BARREL: Speed-D-Burr, 36″ x 32″ dia.
NO. PARTS PER LOAD: 30.
TOTAL CASTING WEIGHT PER LOAD: 900 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 2000 lbs.
KIND OF MEDIA USED: Speed-D-Burr "Smooth Finish."
MEDIA SIZE: 5/16″ – 3 parts, ¾″ – 1 part.
COMPOUND, KIND & AMOUNT: Speed-D-Burr "Fast Cut S", 30 lbs.
WATER: 30 gal.
CYCLE LENGTH: 12 hr.
BARREL SPEED: 6 rpm.

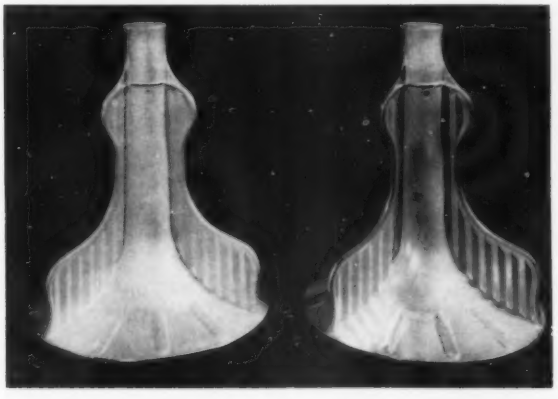


PERMANENT MOLD CAST AIRCRAFT FITTING

FINISHING NECESSARY: Deburr, overall surface improvement.
BARREL: Speed-D-Burr, 60″ x 32″ dia., 6 compartment.
NO. PARTS PER LOAD: 6.
TOTAL CASTING WEIGHT PER LOAD: 108 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 900 lbs.
KIND OF MEDIA USED: Rubber abrasive impregnated diamond shapes.
MEDIA SIZE: ¼″ x ¾″ – 80 grit.
COMPOUND: Speed-D-Burr Fast Cut "A".
WATER: 50 gal.
CYCLE LENGTH: 2 hr.
BARREL SPEED: 10 rpm.

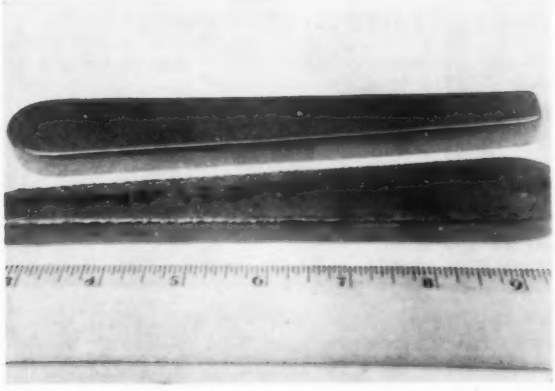
ALUMINUM DIE CAST PIPE STEM

FINISHING NECESSARY: Deflash and provide deep lustrous color. (4 Steps) Note: Step 3 is a Brite-dip in Nitric-Hydrofluoric acid.
BARREL: Roto-Finish, 22″ x 36″ dia.
NO. PARTS PER LOAD: 3250
TOTAL CASTING WEIGHT PER LOAD: 90 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: Steps 1 & 2 – 700 lbs.; Step 4 – 2500 lbs.
KIND OF MEDIA USED: Steps 1 & 2 – Brite-honing; Step 4 – Steel balls.
MEDIA SIZE: Steps 1 & 2 – #4B; Step 4 – ⅜″ dia.
COMPOUND, KIND & AMOUNT: Step 1 – 108, 4 lbs.; Step 2 – 203, 3 lbs.; Step 4 – 380-A, 3 lbs.
WATER: Steps 1 & 2 – 5 gal.; Step 4 – 15 gal.
CYCLE LENGTH: Step 1 – 5 hr.; Step 2 – 2 hr.; Step 4 – 2 hr.
BARREL SPEED: Steps 1 & 2 – 14 rpm.; Step 4 – 12 rpm.



ALUMINUM WASHING MACHINE AGITATORS

FINISHING NECESSARY: Deburr and impart high sheen.
BARREL: Almco fixture barrel.*
NO. PARTS PER LOAD: 16. The agitators are locked in the door fixtures.
TOTAL CASTING WEIGHT PER LOAD: Approximately 128 lbs.
MEDIA USED: 3/16″ burnishing balls.
COMPOUND: Almco No. 15 and No. 41.
WATER: Water is filled to 2/3rds. of load.
CYCLE LENGTH: 20 min.
BARREL SPEED: Medium. The barrel is reversed in direction every 5 minutes. This interval is sufficient to remove burrs and provide a high sheen.



STEEL CAM HANDLE

FINISHING NECESSARY: Deburr – Radius and scale removal.
BARREL: Speed-D-Burr, 36″ x 32″ dia.
NO. PARTS PER LOAD: 600.
TOTAL CASTING WEIGHT PER LOAD: 1000 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 2000 lbs.
KIND OF MEDIA USED: Speed-D-Burr Aluminum Oxite.
MEDIA SIZE: ¾″ x 1″.
COMPOUND: Speed-D-Burr "EHD Cut".
WATER: 20 gal.
CYCLE LENGTH: 14 hr.
BARREL SPEED: 12 rpm.

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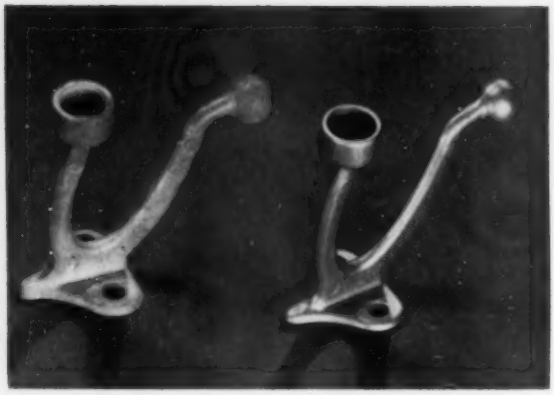
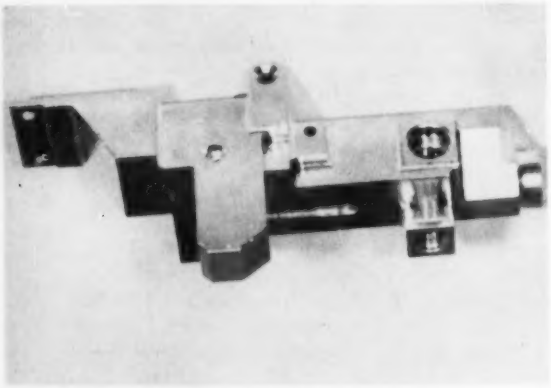


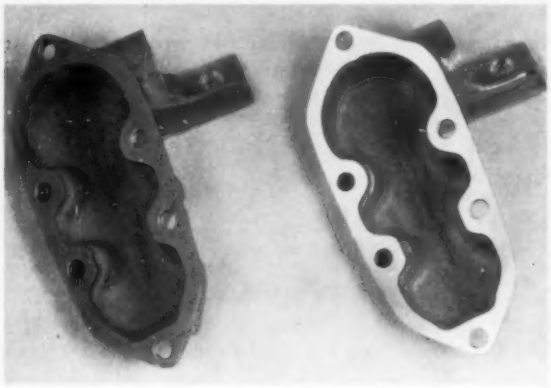
CAST ROCKER BOX COVER

FINISHING NECESSARY: Deburr and improve surface finish.
BARREL: Almco DB 200.
NO. PARTS PER LOAD: 18 per compartment.
TOTAL CASTING WEIGHT PER LOAD: Approximately 20 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 430 lbs.
KIND OF MEDIA USED: #4 Almco Supersheen bonded.
COMPOUND, KIND & AMOUNT: #10 Almco Supersheen burnishing, 1½ lbs.
WATER: 2" below load height. (warm)
CYCLE LENGTH: 2¼ hr.
BARREL SPEED: 8-10 rpm.



ZINC DIE CAST COAT HANGER

FINISHING NECESSARY: Remove parting line and prepare surface for plating. (2 Steps)
BARREL: Roto-Finish, 22" x 36" dia.
NO. PARTS PER LOAD: 1000
TOTAL CASTING WEIGHT PER LOAD: 120 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 700 lbs.
KIND OF MEDIA USED: Brite-honing
MEDIA SIZE: #4B
COMPOUND, KIND & AMOUNT: Step 1 – 10S, 41 lbs.; Step 2 – 380-A, 4 lbs.
WATER: Step 1 – 5 gal.; Step 2 – 10 gal.
CYCLE LENGTH: Step 1 – 6 hrs.; Step 2 – 3 hrs.
BARREL SPEED: Step 1 – 14 rpm.; Step 2 – 14 rpm.



ALUMINUM AIRCRAFT HYDRAULIC FITTING

FINISHING NECESSARY: Deburr and 32 micro-inch finish.
BARREL: Speed-D-Burr, 36" x 32" dia.
NO. PARTS PER LOAD: 40.
TOTAL CASTING WEIGHT PER LOAD: 230 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 600 lbs.
KIND OF MEDIA USED: Rubber abrasive impregnated diamond shapes.
MEDIA SIZE: ¼" x ¾" – 80 grit.
COMPOUND, KIND & AMOUNT: Speed-D-Burr Fast Cut. "A", 26 Oz.
WATER: 35 gal.
CYCLE LENGTH: 4 hr.
BARREL SPEED: 6 rpm.

ZINC DIE CAST FLIPPER HANDLE

FINISHING NECESSARY: Deflash and smooth surface for plating. (2 Steps)
BARREL: Roto-Finish, 22" x 36" dia.
NO. PARTS PER LOAD: 530.
TOTAL CASTING WEIGHT PER LOAD: 100 lbs.
TOTAL WEIGHT OF MEDIA PER LOAD: 700 lbs.
KIND OF MEDIA USED: Brite-honing
MEDIA SIZE: #5B
COMPOUND, KIND & AMOUNT: Step 1 – 10S, 41 lbs.; Step 2 – 203, 3 lbs.
WATER: Step 1 – 5 gal.; Step 2 – 5 gal.
CYCLE LENGTH: Step 1 – 4 hr.; Step 2 – 2 hr.
BARREL SPEED: Step 1 – 12 rpm.; Step 2 – 12 rpm.

CUSTOM POWDERS

continued from page 41

which have previously been regarded as unsatisfactory or even unobtainable in powder metal form. The clean condition and the capability of particle size range and particle shape variation in these powders offer a new horizon to powder metallurgy investigators and fabricators.

[3]U. S. Atomic Energy Commission Publication NYO-8528
Available through Office of Technical Services, Dept. of Commerce

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BOOKS

THE STRUCTURE OF STEEL, By Edwin Gregory and Eric N. Simons, Philosophical Library, New York, N.Y., 1957. Price: $10.00

A simple, non-technical explanation of the metallurgical structure of the various steels and steel alloys. The book is primarily intended for engineers and buyers of steel, rather than metallurgists. The present edition is a revision of the original book, first published in 1938.

The book clearly shows how the properties of any given steel will depend on both its composition and treatment during manufacture. Included is the basic chemistry of iron and steel, with specific reference to the effects of cooling from the liquid state, and atomic and crystalline structure. Also covered are impurities found in steels and the effects of the various processes of metalworking. Modern alloy steels are reviewed with particular attention given to stainless steels and heat-resisting steels.

WELDOR'S TRAINING MANUAL, Inert Gas Process; by Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill., 1958. Price: $1.00 (Free if requested on company letterhead)

This new 144-page training manual is designed to train and qualify individuals in welding aluminum by the inert gas process. Three primary functions, essential to aluminum welding, are covered. The first section of the booklet presents both tungsten-inert-gas and metal-inert-gas welding techniques. Included with this introductory material is data on aluminum alloys and their characteristics directly associated with welding; types of equipment and supplies needed; and tables and other data on welding practices.

The second and third sections of the manual offer step-by-step exercises. These include in part, setting up the equipment, establishing an arc, forming the weld pool, flat position welding, single and multi-pass welding, horizontal and vertical welding and making butt and fillet welds.

The manual is amply illustrated with photographs and schematic drawings.

ENGINEERING FORMULAS AND TABLES, Lefax, Philadelphia, Pa., 1958. Price: $4.75

The 1958 edition of *Engineering Formulas and Tables* is a pocket-size system of loose-leaf data sheets. General headings include Mathematics; Measures; Materials; Gages, Screws, etc.; Mechanics; Electricity & Magnetism; Hydraulics; Structural Data; Reinforced Concrete; Pipe & Fittings; Steam Tables; and Mathematical Tables.

Hammond OF KALAMAZOO

REVERSING EXTRUSION FINISHER

for LOW COST, VOLUME PRODUCTION FINISHING OF EXTRUSIONS, TRIM AND MOULDINGS

The Hammond Reversing Extrusion Finisher is the modern method for finishing extrusions, trim, and mouldings.

Production is increased . . . uniform finishing is assured . . . labor costs will be reduced, when hand operated machines and methods are replaced with this modern finisher.

SEND SAMPLES and we will show you how much you can speed up production and cut costs.

Two-Head Machine shown . . . any number of heads, and length of conveyor, can be supplied to suit your job.

Hammond Machinery Builders INC.

1642 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

For more information circle No. 61 on the Reader Service Card

REDESIGN

continued from page 29

auxiliary piece could be kept down. Now there are only three machining operations, a reduction of 80%. Fillets were easily incorporated to give added strength and scrap losses were practically eliminated. As a bonus, part identification is now cast in, this used to be a separate operation and final finishing is easier and less costly. Now barrel finishing can be used to give the fine surface required.

Overall there has been a reduction in manufacturing costs of 30% and the investment cast part is better.

THE SEWING HOOK

Here's another case (figure 1) where a well engineered investment casting has cut manufacturing costs and given a better end product.

The sewing hook is used on a lot of different industrial machines and varies only in the so-called bridge. By using a tool steel mold and polystyrene patterns the hook is cast to the required accuracy and the variable bridge secured by changing a simple insert in the die.

Conversion from a forging to an investment casting has:

1. Cut machine operations 10%.
2. Cut scrap losses from 50% to less than 5%.
3. Short runs are easily handled with a simple die insert change.
4. Deliveries are more rapid than before.
5. Plant machines are freed for other work.
6. Overall manufacturing costs have been cut by more than 40%.

WHAT'S THE ANSWER

In almost every case where a successful conversion from an older method of manufacturing to investment casting has been made there have been four necessary "success factors;"

1. An open mind by engineering toward new methods.
2. Good know-how by the investment casting foundry.
3. Close cooperation between the consumer and the supplier.
4. Comparison of manufacturing costs at the proper level.

Given these four factors, conversions to investment casting can be successfully made, manufacturing costs can be cut and better products produced.

Which is the best way to tumble finish your parts?

That depends on the size of your part, its shape and how intricate its design. You must allow for the type of metal and whether the part has been stamped, cast or machined. The surface desired is another consideration. To make sure of the best way talk to a Grav-i-Flo engineer. No one in the tumbling business has more experience nor has acquired more knowledge.

METAL PARTS can be deburred and finished more economically than ever with Grav-i-Flo's new 8c a lb. limestone and granite chips.

METAL REMOVAL or fine finish, uniformity and duplication to close tolerances—all are achieved successfully with Grav-i-Flo natural and synthetic chips, highly developed compounds.

AUTOMATION of large quantity lots is accomplished with new automatic machines and accessories, such as chip separator and grader, hoist pans, etc.

PARTS not suited to tumbling and previously finished only by buffing, are now finished to high lustre surfaces with Grav-i-Flo's new Spin-Finish machine.

These and all other variables of mechanical finishing make good reasons for calling Grav-i-Flo engineers for the answers to the *Best Way!*

GRAV-I-FLO CORPORATION • DEPT. PM 2 • STURGIS, MICHIGAN

GRAV-I-FLO PERSONNEL WERE THE PIONEERS — AND ARE *STILL* THE LEADERS IN TUMBLE FINISHING.

TUMBLE GRAV-I-FLO FINISH

For more information circle No. 60 on the Reader Service Card

FIORE ENTERS FINISHING FIELD

Capitalizing on their 15 years of experience in the manufacture of masks and fixtures, WILLIAM M. FIORE, INC. has entered the finishing field as a contract finishing shop to supply services in spraying, stamping, screening, assembly and related operations.

The company has a large stock of jigs, fixtures, automatic spray and assembly equipment which will afford customers a material saving in time and money on finishing operations.

25 YEARS IN DIE CASTING

Joe Johnson, die cast superintendent at CRAMPTON MFG. CO., is celebrating his 25th year in the die casting industry.

Joe started in Canada in buffing and polishing, then moved into die casting production where he has been ever since.

LEWIS NEW SALES MANAGER FOR AURORA METAL CO.

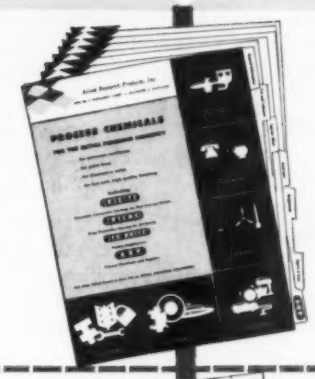
The appointment of B. Frank Lewis as sales manager of AURORA METAL CO., effective January 1, 1959, has been announced by G. B. Peters, president of the company.

FREE DATA FILES
on
Allied Research LINES

LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY

METAL FINISHING PROCESSES

A complete line of quality products and processes developed primarily as a result of helping manufacturers like yourself solve their metal finishing problems. If one of our present products does not meet your needs, we'll be glad to work with you to find an answer to your problem.



IRIDITE® Chromate Conversion Coatings for Non-Ferrous Metals.

IRILAC™ Clear Protective Coatings for All Metals.

ISOBRITE® *Chemically Different* Plating Brighteners.

ARP® *Process chemicals.*

EQUIPMENT AND COMPLETE SYSTEMS
for Metal Finishing

Process Engineered—Single pieces of equipment or all equipment necessary for a finishing operation—evaluated, designed, fabricated, installed and tested to match exactly your particular process. Ask about our *Process Engineering Service.*

WAGNER RECTIFIERS

Silicon and Selenium, built to exacting specifications for long life, trouble-free service.

WAGNER AUTO-LOADERS

for fast, economical transfer of racks and parts, conveyors to plating machines, between conveyors.

AUTOMATIC AND SEMI-AUTOMATIC PLATING MACHINES

BARRELS, TANKS and other equipment.

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Prompt service on a wide variety of daily-use necessities for the plating room, delivered from warehouse stocks strategically located in cities in metalworking areas.

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in copper and zinc.

LECTROCOP® **FLAT COPPER ANODES**

CADMIUM, WHITE BRASS AND TIN ANODES in most efficient shapes. Acid Replacements, Buffs, Chemicals, Cleaners, Maintenance Materials.

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Ask your Allied Field Engineer about our Subscription Plan which combines your new nickel purchases with a service to recast *your* butts and spears, resulting in substantial savings.

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WRITE TODAY FOR COPIES of these useful files describing technical details of our complete line, OR, phone your Allied Field Engineer. He's listed under "Plating Supplies" in your 'phone book.

For more information circle No. 56 on the Reader Service Card

PMM USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the appropriate numbers on the Reader Service Cards, Pages 48-49

PROCESSES

Metal Powder Standards:

METAL POWDER PRODUCERS ASSOC.—has just published the standards for the metal power producers. Included in the standards are methods for sampling finished lots of metal powders, determining hydrogen loss, flow rate, and apparent density of metal powders. Copies are available from the Metal Powder Industries Federation, 130 W. 42nd St., New York 36, N.Y. Cost is $6.00 per set.

Molybdenum In Steel Castings: 154

CLIMAX MOLYBDENUM CO.—A 36-page, technical booklet on the role of molybdenum in heat treated low alloy steel castings, discusses hardenability, tensile properties, fatigue, hardness, etc. Tables, graphs and charts are included.

Forging Aluminum: 155

ALUMINUM CO. OF AMERICA—The equipment, products and services of the company for producing aluminum and magnesium forgings, are described in a 36-page brochure. Properties and kinds of aluminum forgings are listed, and examples are pictured.

MATERIALS & EQUIPMENT

Machinery Catalog: 156

INTERSTATE MACHINERY CO., INC.—A 64-page catalog describes and illustrates the company's entire stock of new, used and rebuilt metal working machinery.

Corrosion Resistant Alloy: 157

HOSKINS MFG. CO.—Technical bulletin describes Alloy #502, a nickel-chromium-iron composition, for mechanical applications that require high resistance to heat and corrosion.

Inert Gas Generators: 158

C. M. KEMP MFG. CO.—Bulletin I-106 gives technical information on 500 and 1,000 CFH panel enclosed inert gas producers. Bulletin I-107 describes a line of purge producers, designed for use where inerts are needed for blanketing, purging, and protective purposes.

Vacuum Metallizing Coils: 159

SYLVANIA ELECTRIC PRODUCTS, INC.—Specifications booklet on "Tungsten Coils for Vacuum Metallizing" contains data on the company's standard vacuum metallizing coils.

Thermocouple Assemblies: 160

CONAX CORP.—Catalog 1885 presents a complete line of thermocouple assemblies and pressure sealing glands. New products are introduced and illustrated.

Alloy Product Listing: 161

SHIELDALLOY CORP.—Product lists of raw materials on experimental alloys, processed minerals and ores, powdered metals and alloys, metals and alloys, boron and boride alloy powder products, and rare metals, metal oxides and alloys, are available.

Conveyor Systems: 162

CONVEYOR SYSTEMS, INC.—Technical brochure gives the design features of power and free trolley conveyor systems.

Thermocouples: 163

BRISTOL CO.—Bulletin lists specifications on Armorox Thermocouples. Available types, materials, sizes, and applications are included.

Thermometers: 164

W. C. DILLON & CO., INC.—Illustrated booklet gives specifications and prices of more than 100 angle form, straight form and special-purpose stainless steel thermometers.

Die Cast Bases: 165

COLUMBIA ENGINEERING CO., INC.—Catalog contains dimensional specifications and pricing charts for all possible types of bases.

Extrusion Presses, Sintering Presses: 166

WATSON-STILLMAN PRESS DIV.—Aluminum extrusion presses in standard designs from 600 to 5000 tons, are described. Powder metal presses, that have opposed rams, horizontal rams, with co-ordinated ram movements, and are available in capacities from 200 to 3000 tons are illustrated in this 24-page booklet.

Die Cast Cap Nuts: 167

GRIES REPRODUCER CORP.—Three standard specification sheets on zinc alloy cap nuts have been issued by the company: Regular closed end cap nuts; Regular open end cap nuts; High closed end cap nuts.

Core & Mold Blowing Machines: 168

BEARDSLEY & PIPER DIV.—A 32-page technical booklet on San-Blo core and mold blowing machines. Diagrams, sketches, photographs and charts showing various operating installations and machine features, are included.

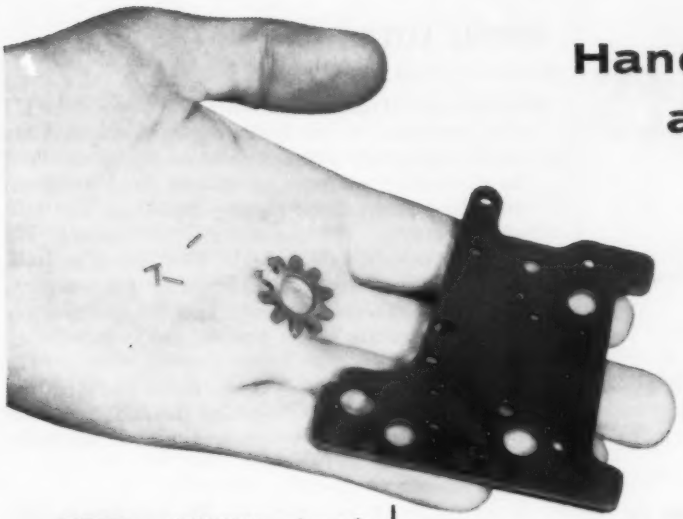
Zirconium Hydride: 169

METAL HYDRIDES INC.—Technical data sheet gives the physical and chemical properties of Nuclear Grade R and Commercial Grade C zirconium hydrade (ZrH_2).

Copper & Copper Base Alloys: 170

OLIN MATHIESON CHEMICAL CORP.—Brochure gives the properties, forms and composition of wrought copper and copper-base alloys. Technical reference charts give nominal composition and available forms.

continued on page 60



Hand Your Deburring and Finishing Problems to ALMCO...

These companies did... and cut costs, improved quality, increased production.

DEBURRING of spark plug bushings by hand formerly caused many rejects at Canadian Pratt and Whitney. Costs were $104.20 per M with rejects totalling 12½%. Two Almco barrel finishing machines cut costs 97%, practically eliminated rejects.

SMALL GREASE GUN COUPLER JAWS (½" x ⅜") couldn't be deburred manually at a midwest screw products firm. With an Almco barrel finishing machine, 40,000 coupler jaws can now be deburred in 10 hours. Jaws are smooth, uniform, ready for plating.

DEBURRING AND POLISHING by manual methods proved expensive for delicate instrument and fountain pen parts at J. Bishop & Co. Almco barrel finishing machine increased output from 200 to 6000 parts per hour, cut costs 98.8%. Annual savings: $6,917.50.

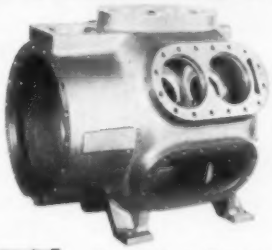
INCREASED PRODUCTION quotas demanded faster finishing at Alco Valve Co. Hand deburring and polishing finished only 200 stainless steel parts per hour. Almco machines are now barrel finishing over 1400 per hour, and to stricter finishing specs. Plant production needs are easily filled.

FILING burrs by hand formerly cost $55 per 100 needle plate forgings at Landis Machine Co. Now an Almco barrel finishing machine has cut finishing costs to 55 cents per 100 parts. Parts are uniform, rejects are eliminated. Savings come to 99%!

HEAVY WORK LOADS of roller bearings presented serious finishing problems at Timken's Columbus, Ohio plant. Now special heavy-duty Almco barrel finishing machines are processing two tons of rollers per load. And 50% of floor space has been saved, finishing costs have been slashed.

Large Parts too are Almco Barrel Finished!

AT AN IOWA FOUNDRY, an Almco barrel finishing machine deburrs, polishes 48 large wash machine agitators per hour. Fixtures hold castings firmly within Almco barrel. Rough edges are completely removed; castings are highly polished; appearance is improved.



AT AIR CONDITIONING FIRM, compressor housings weighing over 100 lbs. are Almco barrel finished. Almco process breaks sharp edges of castings, cleans internal surfaces, and improves surface finishes. Two housings are cleaned in 20 minute cycle! Workmen are relieved for other plant tasks!

Send Your Parts to Almco's Modern Test Laboratory.

Sample parts processed without obligation. Simply write on letterhead, sending parts direct to Albert Lea, enclosing specifications required. Complete, free report includes recommendation. 52 PAGE HANDBOOK ON BARREL FINISHING SENT ON REQUEST.

ALMCO

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Sales and Engineering Offices in Chicago, Detroit, Los Angeles, Newark, New Haven, Philadelphia and London, England.

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TAPERING wall thickness and scientifically-designed side-wall angles minimize swelling and distortion, assure far longer useful life for **acf** Refax Pots. Alloy cast iron absorbs heat rapidly and holds it with minimum reheating. Fast delivery in all styles and sizes. For complete information on the full line of Refax Pots, Ingot Molds, Utility Castings and Goosenecks, write Dept. I-2.

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Plants: Berwick, Pa. • St. Louis, Mo. • Huntington, W. Va.

For more information circle No. 1 on the Reader Service Card

USEFUL LITERATURE

continued from page 58

Fire-Resistant Hydraulic Fluid: 171
E. F. HOUGHTON & CO.—Bulletin gives technical data on Houghto-Safe 620 fire-resistant hydraulic fluid for die casting machines, permanent mold machines, extruding presses, and plating machines.

Tool Economy: 172
F. J. STOKES CORP.—"The Right Tools For The Job", gives helpful hints on tool economy for compacting presses. Tables on punch and die interchangeability, for rotary tablet presses, are included.

Billet Heating: 173
BAL-TATE FURNACE CO.—"Glass Baths For Heating Steel Extrusion Billets", explains the savings in fuel and maintenance cost by preheating steel extrusion billets with this method.

Dynomometers:
W. C. DILLON & CO., INC.—An 81-page design and application book on the use of traction type dynamometers. Engineering data is given with each application. Copies may be obtained by writing, on company letterhead, to the company at P.O. Box 3008, 14620 Keswick St., Van Nuys, Calif. Cost: 50¢.

Extrusion Presses: 174
WATSON-STILLMAN PRESS DIV.—Aluminum extrusion presses, hydraulic stretchers, and complete plant layouts, are presented in an illustrated brochure.

Cyanide Copper: 175
METAL & THERMIT CORP.—Literature describes bright cyanide copper, that has speed, stability, economy, and simplicity.

Iron Powders: 176
PYRON CORP.—Brochure gives technical data on 100 mesh hydrogen reduced powder, Niagra 100 mesh iron powder, and miscellaneous grades.

Hydraulic Control Systems: 177
GENERAL REGULATOR CORP.—Hydraulic controls, actuators and power units for industrial processes, test facilities, and machine automation are described in Bulletin GR-58-4.

Thermocouple Wire: 178
CLAUD S. GORDON CO.—Engineering Data on sheathed thermocouple wire, with ceramic alloy insulation. Bulletin No. 1200-4.

Carbon & Graphite Uses: 179
STACKPOLE CARBON CO.—A 56-page technical manual gives the properties, applications and performance data on a wide range of carbon and graphite products manufactured by the company.

Power Tools: 180
ROCKWELL MFG. CO.—Industrial power tools and accessories, are presented, with specifications, in a 88-page catalog.

Booster Vacuum Pumps: 181
F. J. STOKES CORP.—Mechanical booster vacuum pumps, that operate in the pressure range from 10 microns to 1 millimeter, are described in technical data.

Bonding Agent: 182
BAROID DIV., NATIONAL LEAD CO.—Data describes National Bentonite, a bonding agent for sand molds. It is said to give a fine finish on brass, aluminum, magnesium and iron and steel.

FINISHING

Vibratory Finishing: 183
LORD CHEMICAL CORP. — Bulletin 258 describes the Lorco Vibrator, a precision finishing machine that is said to be from 10 to 100 times as fast as tumbling barrels.

Barrel Finishing Compounds: 184
OAKITE PRODUCTS, INC.—Booklet describes the company's compounds for deburring, burnishing, and descaling metals. The selection of the right media, solution, speed, and loading, is discussed.

Inserts: 185
HELI-COIL CORP.—Design manual and catalog on the company's entire line of inserts for commercial use. Specifications and applications are included.

Plating Chemicals: 186
HANSON-VAN WINKLE-MUNNING CO.—Technical brochure on anodes and plating chemicals. Composition, shapes and specific application, are given for a wide variety of anodes, anode hooks and anode bags.

Ultrasonic Cleaner: 187
NARDA ULTRASONICS CORP.—Literature describes the Series 5000 SonBlaster. The unit consists of a 40-kc, 500-watt generator, and a 10-gallon capacity transducerized cleaning tank.

Temperature Control: 188
PARTLOW CORP.—Bulletin describes the company's new pneumatic controls for plating and metal finishing temperature control in corrosive atmospheres.

Contour Abrasive Heads: 189
ABRASIVE MACHINERY CORP.—Literature describes the Smooth-O-Matic, a contour abrasive head for extremely fine to coarse finishing on flat or contoured surfaces.

Aluminum Etch Cleaner: 190
ENTHONE, INC.—Literature describes, Etchalume 14, an etching and cleaning compound for aluminum. It is a powdered material, which produces a uniform etch and leaves the aluminum surface clean of aluminum hydroxide.

Dip & Rinse Tanks: 191
WHEELABRATOR CORP.—Bulletin No. 400 describes 4 models of all-steel dip and rinse tanks for precision finishing processes. Inside dimensions are: 24″ deep, 24″ long, and 16″ wide. Capacity is 40 gallons.

Analyze Cleaning Costs: 192
E. I. DU PONT DE NEMOURS & CO.—The High-Spot method for analyzing metal cleaning costs, is a new method for quickly analyzing and comparing costs by use of the standard cost factors in the booklet.

Chemical Milling: 193
U. S. CHEMICAL MILLING CORP.—Brochure describes the company's facilities for chemical milling, spinning, 3-D machining, profiling, cavity milling, skin milling turning, forming, etc.

Plating & Processing Machines: 194
MEAKER CO.—Bulletin U-658 describes Uniline single row plating and processing machines. Specifications and illustrations of the machines are included.

Electro-Chemical Machining 195
ELOX CORP.—Literature describes a new method of metal removal that relies on an electro chemical or electrolytic action on the part being machined.

DIE MAKERS — DIE CASTERS

Standardize with D-M-E and Save!

Reduce design time and cut die construction costs with these D-M-E STANDARDS—combined to fit your needs!

For added savings, start with D-M-E Standards—they're "better to begin with" because they're made of the finest steel, finish-ground flat and square. Only D-M-E Standards give you "custom-made" construction with the cost-saving benefits of standardized, interchangeable components.

RACK and PINION EJECTION
HYDRAULIC EJECTION
D-M-E Standard Cavity Retainer Sets
From 9¾" x 8" to 23¾" x 35½"
D-M-E Standard EJECTOR BOXES up to 18" x 35½"
D-M-E Standard EJECTOR HOUSINGS up to 23¾" x 35½"
Welded Steel Construction (Patented)—30% lighter than cast-iron boxes!
Write for 170 page D-M-E Catalog, listing complete data and prices—or call or write your nearest D-M-E Branch TODAY for additional information.
58-E

DME DETROIT MOLD ENGINEERING CO.

Contact Your nearest Branch for Faster Deliveries!
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  HILLSIDE, N.J.: 1217 Central Ave.—LOS ANGELES: 3700 S. Main St.
- D-M-E CORP., CLEVELAND: 502 Brookpark Rd.—DAYTON: 558 Leo St.
- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

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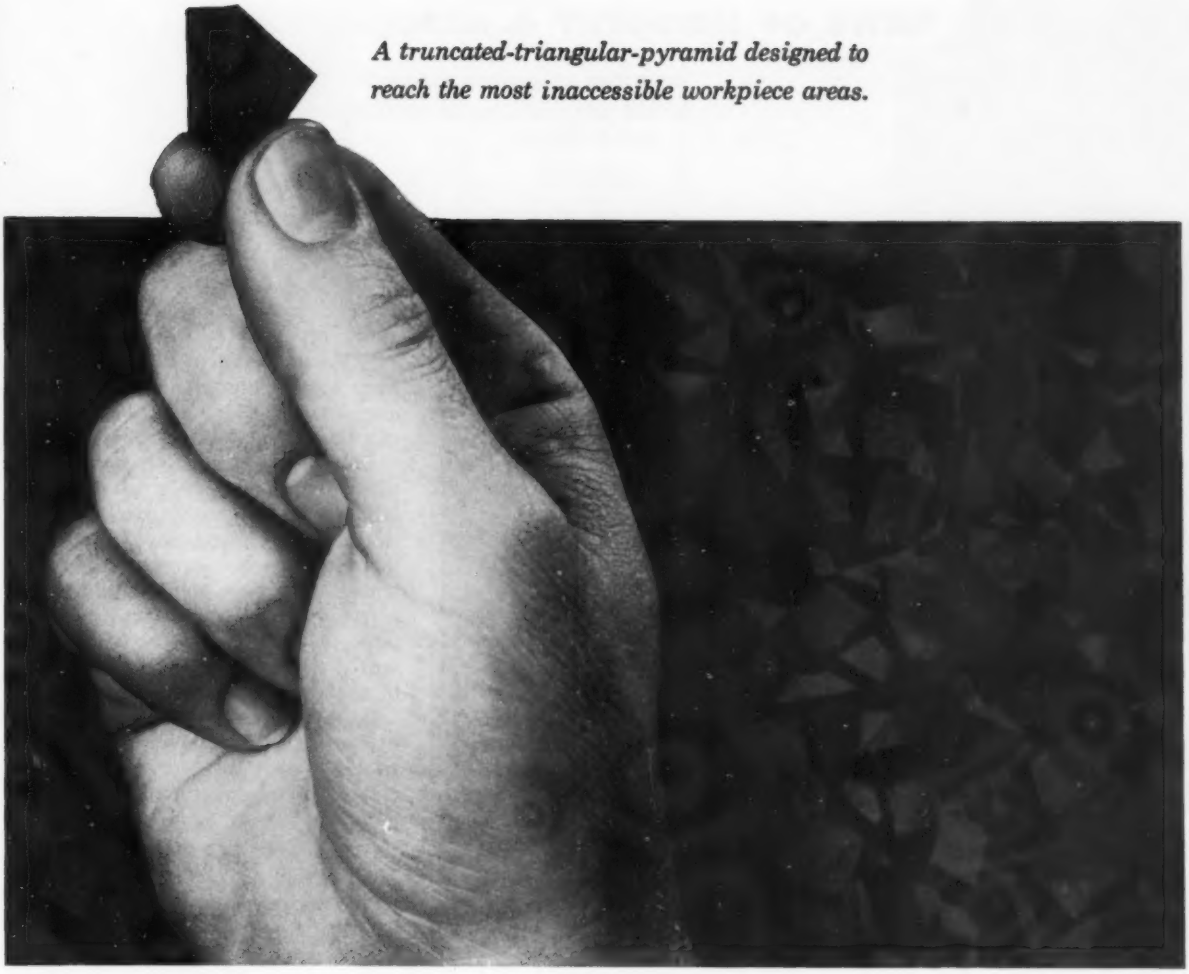
NEW FROM "3M"

A super-speed abrasive that licks all three barrel finishing problems!

1. **DISCOLORATION** You get the world's *cleanest* workpiece surfaces with HONITE "C-R" Tumbling Shape. Its unique binder resists wetting as it wears away—won't attract or unite with dirt; doesn't cling to the workpiece.
2. **IMPINGEMENT** HONITE "C-R" Tumbling Shape will not nick or impinge surfaces or edges of work. It's *super-light* to produce superior micro-inch surface finishes, smooths off edges and radii in record time. Burrs are cut off before they can be peened over!
3. **FRACTURING** New HONITE Brand "C-R" Tumbling Shape *will not* fracture or fragment in the barrel. This virtually eliminates the annoying problem of lodging of media particles in pockets or threads of workpieces.

All this plus a cutting speed unsurpassed by any abrasive chip on the market today!

A truncated-triangular-pyramid designed to reach the most inaccessible workpiece areas.



Honite BRAND "C-R" TUMBLING SHAPE

GET THE COMPLETE STORY:

Find out yourself how, for the first time, you can now get these characteristics combined to such a high degree in one tumbling medium. Use this coupon.

MINNESOTA MINING AND MANUFACTURING COMPANY

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NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

ENTHONE BUILDS NEW METAL FINISHING LABORATORY

HEAD OF THE LABORATORY, Dr. Walter R. Meyer (standing) is shown discussing a customer problem with the laboratory staff.

A new research and development laboratory has just been completed by ENTHONE, INC., tripling the company's research facilities.

While development of new and better metal finishing methods will remain one of the prime functions of the laboratory, equally important is customer service. For this, a greatly enlarged pilot plant has been provided. It is set up to closely approximate actual plant operating conditions and will be used to study problems in plating, cleaning, blackening, acid dipping, buffing, barrel finishing, etc. Almost any commercially important metal can be studied.

In addition to research and pilot plant work, the personnel of the laboratories will work closely with the Enthone engineering department so that when a customer problem or a new development has been carried through development and pilot plant stages it can be presented to the customer in the form of an integrated plant lay-out.

As in the past, work of the laboratory will be actively directed by Dr. Walter R. Meyer, president and technical director of the company.

COMAZZI NEW VICE PRESIDENT OF ADVANCE PRESSURE CASTINGS

COMAZZI

Mr. Alfred Schneier, Jr., president of ADVANCE PRESSURE CASTINGS, INC., has announced the appointment of Joseph J. Comazzi as vice president in charge of manufacturing and Walter S. Borny as assistant sales manager.

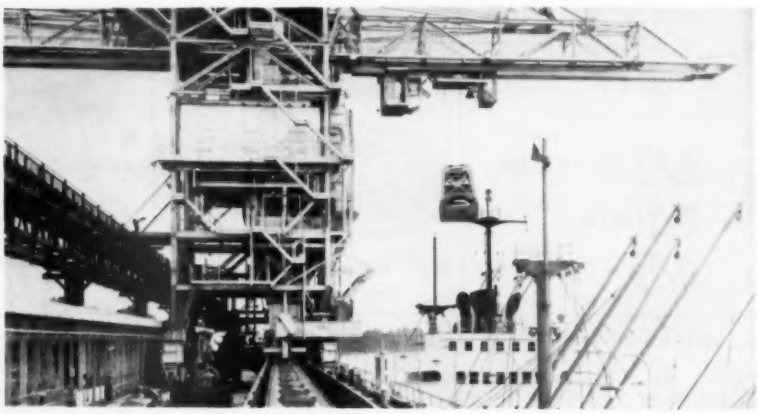
Mr. Comazzi is a graduate industrial engineer and prior to coming with Advance was methods engineer at Fairchild Aerial Camera.

ORMET CORP. LEASES GULF COAST MARINE TERMINAL

Located about 30 miles below Baton Rouge on the Mississippi river, the new bulk marine terminal built by the Baton Rouge port commission has been leased to OLIN MATHIESON CHEMICAL CORP.

The marine terminal is located adjacent to the new alumina plant built there by the Ormet Corp. While Ormet's principle interest in the terminal is for handling bauxite brought in for their alumina plant, the terminal will handle a volume of cargo far in excess of Ormet's requirements.

With the start of full production later this year, the Ormet plant will use 60,000 tons of liquid caustic soda and 700,000 tons of bauxite per year. Bauxite will be brought to the terminal in ocean going vessels from the mines in Surinam.



ICI ELECTS NEW OFFICERS

MILLER

The Investment Casting Institute, meeting in New York for its sixth annual meeting elected new officers and directors. Those elected are: president, Robert R. Miller, president Precision Metalsmiths, Inc.; vice president, John H. Morison, president, Hitchiner Mfg. Co.; treasurer, K. W. Thompson, president K. W. Thompson Tool Co. New directors elected are: Dr. Jack Keverian, General Electric Co.; E. A. Democh, York Castings, Inc.

According to Miller, the investment casting industry can look to increased commercial business during the coming year. New commercial applications and some improved methods should help the industry overcome the slump that resulted from the cut-back in defense spending for aircraft parts.

During 1958, eight new members were added to the Institute. Six regular members are: McPherson Precision Castings, Connecticut Investment Casting Co., Dean Precision Casting Co., Humphrey Castings, Inc., Pointer Tool Co., and Supreme Precision Castings, Ltd. Affiliate members added are: The International Nickel Co. and H. J. Sherwood, Inc.

The regular spring technical session will be held March 17, 18 & 19, 1959 in Santa Monica, Calif.

BUSS MACHINE WORKS SOLD

Mr. A. H. Eggers, president of Greenlee Bros. & Co. has announced the purchase of the BUSS MACHINE WORKS and its subsidiary B & T MACHINERY CO.

The purchase will expand the well known line of metal working machinery manufactured by Greenlee by adding B & T's die casting machine building facilities. The woodworking machinery made by Buss will be added to the line now made by Greenlee Tool Co.

Months and months ago, Latrobe produced intricate parts and shapes for many new products scheduled in 1959 and the years beyond . . .

Long before these designs of "things-to-come" were completed on the drawing boards, those behind the products had turned to Latrobe! For they knew from past experiences and performances, Latrobe has the facilities to produce quality Die Castings!

Furthermore, they knew Latrobe maintains modern testing, development and research laboratories, manned by qualified metallurgical engineers dedicated to technology, whose specialty is to meet the precise physical and characteristic requirements of the specifications!

Finally, they knew the Latrobe reputation for workmanship, service and economy whether on small or large quantity production runs.

Send for your copy of "Latrobe Castings" on your letterhead. It tells the inside story why L.D.C. Aluminum, Zinc and Lead Die Castings sparkle the 1959 new product parade!

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Tel: Portage 2-7663

CLEVELAND, OHIO
William Kranz
19615 West Lake Road
Tel: Edison 1-4888

DAYTON, OHIO
J. M. Gallaher
363 West First St.
Tel: Baldwin 4-3523

DETROIT, MICHIGAN
J. R. Lemen, Jr.
1016 Fisher Bldg.
Tel: Trinity 3-5910

NEW ENGLAND
R. L. Thomson
79 Prospect St.
Stamford, Conn.
Tel: Fireside 8-3985

PHILADELPHIA, PA.
Albert B. Reid
505 Wadsworth St.
Tel: Chestnut Hill 7-8833

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***Latrobe Die Casting Co.**
Latrobe, Pennsylvania

Established 1918

To Make the Best — Begin with the Best Castings!

For more information circle No. 36 on the Reader Service Card

FOUNDER OF WHEELABRATOR CORP. DIES

Verne E. Minich, founder of WHEELABRATOR CORP., and honorary chairman of the board, died Dec. 13, 1958 following an illness of several months.

Mr. Minich founded the company in 1908 under the name of the Sand Mixing Co. Later through the acquisition of other products and the development of new products, notably the airless abrasive blast cleaning unit, the company grew until finally in 1955 the name was finally changed.

HARBISON-WALKER BUILDS NEW RESEARCH CENTER

The Garber Research Center of HARBISON-WALKER REFRACTORIES CO. was opened recently. The new facility, named after the company president, Earl A. Garber, is one of the most modern and fully equipped refractory research laboratories in the country.

The new 45,000 sq. ft. building houses both laboratory and pilot plant facilities. Both fundamental and applied research will be stressed by an enlarged staff of research men.

FOUNTAIN NEW TECHNICAL REPRESENTATIVE FOR MISCO

FOUNTAIN

To give specialized attention to the automotive and industrial fields, MISCO PRECISION CASTING CO. has appointed Jesse R. Fountain as technical representative.

Before coming to Misco, Mr. Fountain had extensive experience with both automotive and industrial companies in sales and sales engineering.

ARWOOD CREATES NEW POST AT V.P. LEVEL

MATTHIESON

SHIEL

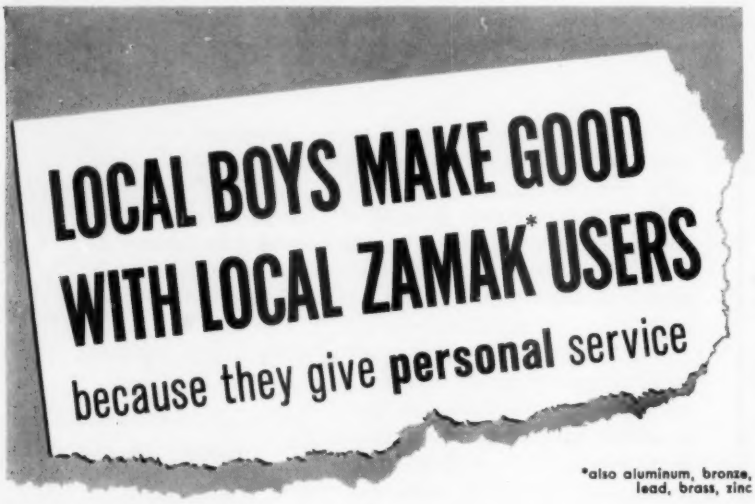
Process engineering, the bridge between the laboratory developments and practical plant production is becoming an ever more important position in many manufacturing concerns.

ARWOOD PRECISION CASTING CORP. has recognized the need for this function and has appointed Harry Matthieson to the newly created post of vice president of process engineering.

At the same time, Joseph J. Shiel was promoted to plant manager of the Brooklyn, N.Y. plant; a position left vacant by Matthieson.

OAKITE REPRESENTATIVES IN TEXAS AND KANSAS

Two new technical service representatives for OAKITE PRODUCTS, INC. have been announced. J. D. Rodgers will be located in Houston and R. A. Nederman in Kansas City.



At HB&S you can

- **pick up the phone and get the answer to your question** on the spot
- **call an order in for** same day shipment, **in an emergency**
- **receive palletized delivery to any point** within your plant **and the many other big little things that help you produce a better product at lower costs.**

At HB&S you get big-order, big company attention. Service is individualized to fit **your** needs . . . specifically **engineered** to meet **your** requirements.

See what a difference HB&S service . . . HB&S quality make:

Spectrographic analysis of all production

Alloy number on every ingot

Heat number on every pallet

Start-to-finish quality control for alloys

100% on spec.

And yours for the asking Henning's Pocket Guide to Better Casting

Write TODAY for your copy of "Die Casting with Zinc Base Alloys" explaining the factors influencing the production of sound castings and the causes of faults and defects.

HENNING BROS. & SMITH, INC.

91-117 Scott Ave., at Randolph St., Brooklyn, N. Y.
Smelters and refiners of aluminum, bronze, brass, zinc, lead
Dependable service since 1922

For more information circle No. 24 on the Reader Service Card

Thousands of extra pours per ladle, with less effort for the operator

the Spincraft STAINLESS STEEL ladle

for non-ferrous metal pouring

LIGHT
TOUGH
LONGER-
LASTING

If you pour non-ferrous alloys, Spincraft ladles will save you replacement costs and make the job much easier. Designed to reduce operator fatigue by their lightness, balance, and non-spill shape, they resist burning-through as only stainless steel with its high critical melting point can do. Spincraft ladles come in 23 sizes, from ¼ lb. to 30 lb. molten metal capacity.

- 75% lighter than cast iron ladles
- Amazingly long life
- Shot-blasted for coating adhesion
- Deep conical form makes pouring easier, minimizes spillage
- Can be used for zinc and other metals without coating
- "Whack proof" handle arc-welded to reinforced cup edge
- Built to last longer, work lighter. Let your operator use one, then try to take it away from him!

Complete handle on ¼ lb. through 9 lb. size; 10 through 30 lb. size has handle bracket stub to which proper length handle can be attached.

Also...Spincraft STAINLESS STEEL Skimmer

A skimmer that really skims! Shallow radius skims surface impurities instead of ladling as deeper-cupped skimmers do. Correct size holes prevent clogging. Short handle stubs fit common pipe and permit attachment of length and type handle you want.

IN FOUR DIAMETERS: 6 inch, 8 inch, 10 inch, 12 inch.

Spincraft ladles and skimmers are also available in low-cost mild steel.

Spincraft
STEEL WILL DO IT

Write for complete data and prices today.

SPINCRAFT, INC.
4138 West State St., Milwaukee, Wis.

Send us complete information on:

Stainless Steel	Mild Steel
☐ Ladles	☐ Ladles
☐ Skimmers	☐ Skimmers

Company .....

Address .....

City ..... State .....

Name .....

Circle No. 52 on the Reader Service Card

NEW PRESIDENT ELECTED FOR PANGBORN CORP.

TRENT

Following the death of Victor F. Stine, Ralph M. Trent has been elected president of PANGBORN CORP. At the same time, Robert H. McCauley was elected a director of the corporation.

Mr. Trent has been associated with Pangborn for 28 years, starting as district manager in Pittsburgh, where he was for 14 years. He then moved to the West Coast as district manager for a period of 10 years.

Mr. McCauley has been general counsel for the company for the past 30 years.

Cut Finishing Costs THROUGH INCREASED PRODUCTION

AUTOMATIC MACHINES
Increase production hundreds to one over hand methods. Reduce labor costs. Eliminate need of experienced workmen.

CLAMPS AND FIXTURES
Positive pressure and exact registration of the part in the mask. Reduce rejects. Free both hands for productive movements.

SPRAY PAINTING MASKS
A competent engineering staff will counsel with you on the most efficient technique for handling your particular requirements.

MASK WASHING MACHINES
50% faster than any other make. Cut solvent consumption. Avert production delays due to damaging of masks by hand scrubbing.

C-M

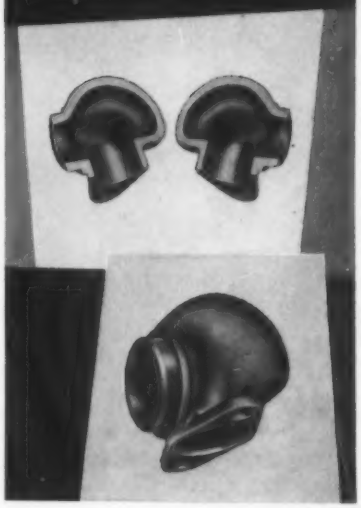
Send for Free Literature Now

Conforming Matrix CORPORATION

348 TOLEDO FACTORIES BUILDING TOLEDO 3, OHIO

Circle No. 58 on the Reader Service Card

two halves *don't* make a hole!



. . . *with* INVESTMENT CASTING *it's made in one piece.*

We don't tackle casting problems halfway at Hitchiner.

Here's a cross section where the inside dimensions are greater than the holes. Originally made in sections and assembled — now the whole unit is precision cast and is lighter and stronger.

Where application requirements demand that a part be of intricate shape; of unusual contour, of fine detail, or of metals difficult or impossible to machine — investment casting provides an efficient and economical solution.

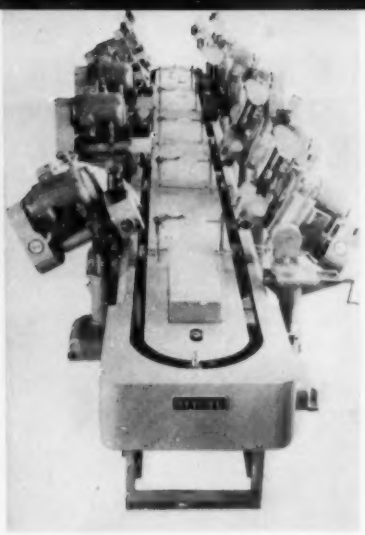
Only your production costs are cut in half when you utilize the efficiency of investment casting. You save time and plenty of labor. And . . . you'll have a wide selection of metals; the non-ferrous group, the carbon and low alloy steels, the hard-to-form, hard to machine high alloy steels . . . even cobalt base alloys.

For complete details, see this new illustrated, informative booklet on the art of Investment Casting. It could be the best investment you ever made.

HITCHINER
MANUFACTURING COMPANY, INC.
MILFORD 43, NEW HAMPSHIRE

Representatives in Principal Cities

Circle No. 23 on the Reader Service Card



NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 48 of this issue

CIRCUIT CONVEYOR . . . is indexing type

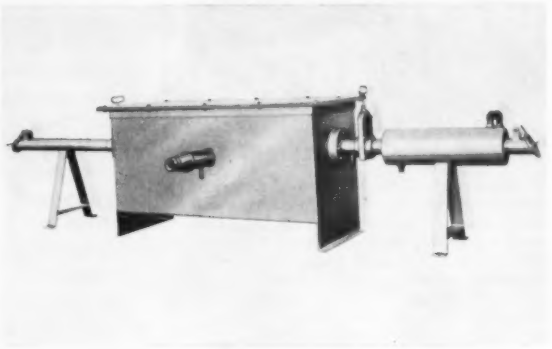
An indexing type circuit conveyor, for use with type "L" and "V" polishing and buffing head units, has been announced by DIVINE BROS. CO. The conveyor is sectional. This permits the addition of a loading end, a drive section, and any number of intermediate sections. The conveying medium is provided by two strands of roller chain running over double sprockets on vertical shafts. The indexing conveyor drive consists of an enclosed motor through a magnetic clutch and brake mechanism, through a gear reduction unit and is coupled to the conveyor sprocket shaft.

Circle No. 205 on Reader Service Card

TUBE FURNACES . . . are carbon-resistor

With this carbon-resistor tube furnace temperatures to 5000° F. can be rapidly reached and uniformly maintained. The furnaces, manufactured by HEVI-DUTY ELECTRIC CO., are available in 6 sizes ranging from 1" x 12" to 5" x 48". The dimensions refer to internal heated length. Temperatures are regulated by a fully automatic saturable reactor control system. 5000° F. can be reached in two hours. Gates on both ends of the heated zone minimize radiation losses into the charge chamber and cooling chamber.

Circle No. 206 on Reader Service Card



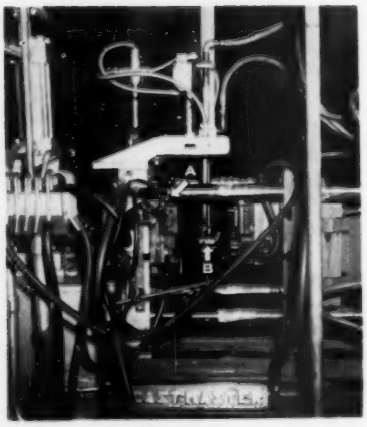
FIXTURED DEBURRING & FINISHING . . . for many parts

The main advantage of this Mechamatic Unit, No. MM-4-8, is the handling of paired components which must be deburred and remain together. Parts are mounted on spindle fixtures, air operated, which are submerged, while rotating, in a fluid of abrasive mass which simulates a form fitting grinding wheel. The parts travel at a rate of 300 to 600 S.F.M.

The machine, manufactured by MECHA-FINISH CORP., will produce 480 pieces per hour at a one-minute time cycle.

The machine is completely automatic and controlled except for loading and unloading the parts. No special skill is required for loading and unloading. Machines for smaller components, where the time cycles vary from 3 to 6 seconds, are also available.

Circle No. 207 on Reader Service Card



DIE LUBRICATOR & BRUSH MECHANISM . . . are automatic

A system for automatically lubricating die surfaces, has been developed by CAST-MASTER, INC. The nozzle, Figure A, is mounted at the upper corner of the die area. At the end of every cycle, every other cycle, or at any spacing desired, die lubricant is automatically sprayed into the die area.

A brush mechanism, Figure B, has also been introduced, that automatically moves downward at the end of every cycle, through the open die. This serves to clean the die faces of flash and foreign matter. The brushes are set in an adjustable holder.

Both of these automatic systems can be installed on the company's 100 and 800 Ton machines, and are available on the new models.

Circle No. 208 on Reader Service Card

continued on page 70

You get speedier service from the

ZINC ZONE

Central location of American Zinc plants assures prompt deliveries of slab zinc to any point in the nation.

HILLSBORO, ILL., PLANT
Prime Western, Brass Special, Intermediate, High Grade, Continuous Galvanizing Grades
MONSANTO, ILL., ELECTROLYTIC PLANT
Special High Grade, High Grade, Continuous Galvanizing Grades, Special Shapes
FORT SMITH, ARK., SMELTER
Prime Western, Brass Special
DUMAS, TEXAS, SMELTER
Prime Western, Brass Special, Continuous Galvanizing Grades

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

American Zinc Sales Company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY

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For more information circle No. 8 on the Reader Service Card

PLAST-IRON POWDERS

REPLACE WITH

B-280

Standard 80 Mesh Iron Powder

IMPROVE WITH

B-281

Phos Enriched 80 Mesh Iron Powder

ECONOMIZE WITH

B-270

35 Mesh Reduced Iron Powder

PM 9d

Send for Technical Data and Working Sample

PM PLASTIC METALS

PLASTIC METALS

Division

National-U.S. Radiator Corporation

3459 BRIDGE STREET

JOHNSTOWN, PA.

Circle No. 43 on Reader Service Card

NEW PRODUCTS—

continued from page 68

ELECTROSTATIC SPRAY SYSTEM

. . . is multi-color

A centrifugal type electrostatic spray system has been developed by the IONIC ELECTROSTATIC CORP. The system can produce both single and multi-color patterns or finishes. The system ultilizes an array of variable speed electrostatically charged centrifugal atomizers, for blending the coating materials. Reciprocating and stationary models are available.

Circle No. 220 on Reader Service Card

CUTTING STEEL

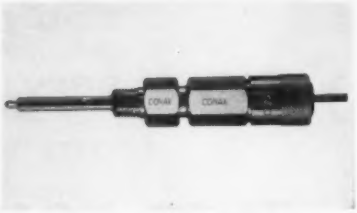
. . . is ultra-hard

CA-604, a super high speed cutting material, developed by the ALLEGHENY LUDLUM STEEL CORP., operates in the fast cutting ceramic area. It features high strength at high cutting temperatures. The grade combines high velocity finishing with light to medium feeds.

Circle No. 221 on Reader Service Card

THERMOCOUPLE GLAND

. . . seals two or more bare wires



The Type "C" Conax Bare Wire Thermocouple Gland, provides a positive method for sealing 2 or more bare wires at pressures from .005 microns to 20,000 psi. Manufactured by the CONAX CORP., the gland seals and terminates up to 8 bare wires of 24, 20, or 14 gage. It can be furnished with an open end tube to provide mechanical protection for the wire in high velocity or viscous fluids.

Circle No. 214 on Reader Service Card

FURNACE

. . . for close atmosphere control

This electric furnace, manufactured by the ELECTRIC FURNACE DIV., HARROP CERAMIC SERVICE CO., is adapted for close control of at-

6 GOOD REASONS

Why You Should Specify

MERRIMAN POWDERED METAL PARTS

1. HIGHEST QUALITY — ALL WAYS
2. GUARANTEED TO FIT
3. DIMENSIONALLY ACCURATE
4. PROVEN PERFORMANCE
5. LOW COST
6. FASTEST DELIVERY

Originators of Sintered Helical Gears High Density, precision structural parts from powdered metal in

Brass, Bronze, Copper, Nickel Silver Steel, Iron and Iron Alloys. Copper Infiltration

POWDERED METAL DIVISION

MERRIMAN BROS., INC.

185 Amory Street Boston 30, Mass.

REPRESENTATIVES IN PRINCIPAL CITIES

4324 W. Florissant Ave. St. Louis, Missouri

33 University Ave. Rochester, New York

P. O. Box 181 West Concord, Mass.

For more information circle No. 46 on the Reader Service Card

Will your new products stand the sales test?

Many products using Monarch Exploratory-Engineered Castings are among the nation's sales leaders. Today's competitive markets demand new features.

This is another area where Monarch gives valuable assistance to customers. Monarch Exploratory-Engineering has created many sales-sparking casting performances and eye-catching finishes. Write today. We will be happy to show you specifics.

Engineered-for-sales aluminum permanent mold castings, aluminum and zinc die-castings.

MANUFACTURING in MOLTEN ACHIEVEMENTS ALUMINUM

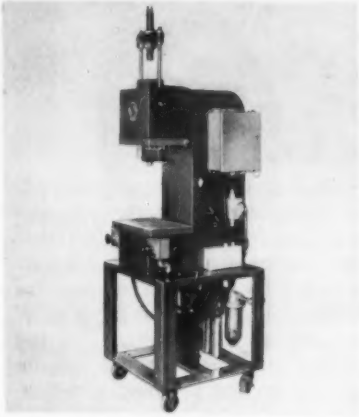
MONARCH ALUMINUM MFG. COMPANY
9205 Detroit Avenue Cleveland 2, Ohio

Circle No. 41 on the Reader Service Card

mospheres and temperatures. The sealed housing insures retention of the atmosphere in the firing chamber. Setting space is 12″ x 12″ x 16″ high. The furnace elements are of the non-metallic resistor type. Upper and lower element banks can be controlled independently, either by manual adjustment or separate instrumentation. The furnace operates to 2800 F.

Circle No. 215 on Reader Service Card

PRODUCTION PRESS
. . . is high-speed



This air-hydraulic high speed production press features positive ram speed and stop control with no overtravel. Ram pressure is adjustable from 2 to 12 tons with identical speed cycle. Ram cycle speed of 2000 minimum per hour with 6″ down and return is possible. Daylight between ram and bottom plate is 12″. Throat depth is 6½″. The press, manufactured by STUDEBAKER HYDRAULIC PRODUCTS CO., is available in 2½, 5 & 10 ton capacities.

Circle No. 210 on Reader Service Card

AIR-LINE REGULATORS
. . . are relieving-type

Relieving-type air line regulators have been introduced by the BELLOWS CO. A built-in pressure relief valve allows increases in downstream pressures to "bleed" harmlessly into the atmosphere when the pressure exceeds the regulator setting. The regulators will reduce primary line operating pressures of up to 250 psi. and will maintain desired downstream pressures of 0 to 50 psi, 0 to 125 psi, 0 to 250 psi, obtainable from separate units.

Circle No. 222 on Reader Service Card

continued on next page

ZINC AND ALUMINUM DIE CASTINGS

- **PRECISION MACHINED**
- **COMPLETE ENGINEERING AND DIE FACILITIES**
- **AUTOMATIC CHROME PLATING**

Our complete facilities, from design to finishing, enable us to meet your varied die casting requirements regardless of size or complexity.

Write to:

Wolverine Die Cast Corp.
13700 MT. ELLIOTT
DETROIT 12, MICH.
FOrest 6-9675

Circle No. 17 on the Reader Service Card

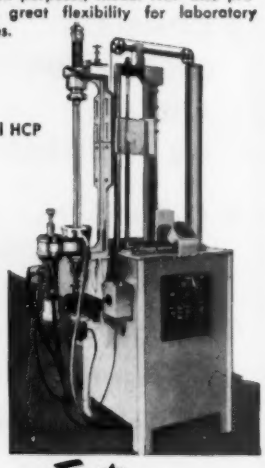
Lepel induction heating equipment represents the most advanced thought in the field of electronics . . . the most practical and efficient source of heat developed for numerous industrial applications.

You are invited to send samples of work with specifications. Our engineers will process and return the completed job with full data and recommendations without cost or obligations

FLOATING ZONE UNIT FOR METAL REFINING AND CRYSTAL GROWING

A new floating zone fixture for the production of ultra-high purity metals and semi-conductor materials. Purification or crystal growing is achieved by traversing a narrow molten zone along the length of the process bar while it is being supported vertically in vacumm or inert gas. Designed primarily for production purposes, Model HCP also provides great flexibility for laboratory studies.

Model HCP



Features

- **A smooth, positive mechanical drive system with continuously variable up, down and rotational speeds, all independently controlled.**
- **An arrangement to rapidly center the process bar within a straight walled quartz tube supported between gas-tight, water-cooled end plates. Placement of the quartz tube is rather simple and adapters can be used to accomodate larger diameter tubes for larger process bars.**
- **Continuous water cooling for the outside of the quartz tube during operation.**
- **Assembly and dis-assembly of this system including removal of the completed process bar is simple and rapid.**

Electronic Tube Generators from 1 kw to 100 kw.
Spark-Gap Converters from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG

All Lepel equipment is certified to comply with the requirements of the F.C.C.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, N. Y.

Circle No. 34 on the Reader Service Card

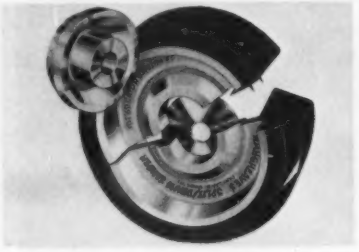
NEW PRODUCTS—
continued from page 71

MILLING MACHINE
. . . for die casting dies

THE CINCINNATI MILLING MACHINE co. has introduced a three-dimensional hand guided hydraulic tracer controlled machine. The 3D unit controls the direction of traverse of the table and saddle for 360 degree horizontal profiling, and the vertical movement of the spindle quill for vertical profiling. A deflection of the stylus results in a corresponding movement of the table, saddle, spindle and quill. A maximum of 25" per min. may be obtained.

Circle No. 211 on Reader Service Card

SANDER
. . . has split drum



HARGRAVES INDUSTRIAL has introduced a split-drum sander that accommodates inexpensive strips of coated abrasive. The wheel can be used for metal removal, buffing and polishing operations.

Circle No. 216 on Reader Service Card

DIFFUSION PUMP
. . . is air-cooled

An air-cooled fractionating oil diffusion pump, with an internal casing diameter of 2", has been

You save space and weight with the

NEW SELF-LUBRICATING SPLIT THRUST BEARINGS

National split thrust bearings are light, take little space. Assemble them quickly to hold against rotation and high thrust. Eliminate bulky, heavy threaded washer-and-nut or set-screw collar assembly.

(Patent Applied For)

WRITE TODAY for illustrated folder and data sheet. You'll be amazed at the money you save! National split thrust bearings will be made in standard shaft sizes from .250 to 3.00.

POWDERED METAL PARTS
NATIONAL
MOLDED PRODUCTS INC.
PRECISION ENGINEERED

NATIONAL
MOLDED PRODUCTS, INC.
ST. MARYS, PENNA.

For more information circle No. 42 on the Reader Service Card

announced by the ROCHESTER DIV., CONSOLIDATED ELECTRODYNAMICS CORP. The pump has a new baffle that reduces vapor backstreaming. With the baffle, the pump has a minimum speed of 40 liters per sec in the 2×10^{-5} to 7×10^{-3} mm Hg range, with a peak speed of 48 liters per sec at 5×10^{-4} mm Hg. The pump will attain an ultimate pressure of 2×10^{-6} mm Hg.

Circle No. 212 on Reader Service Card

MACHINED BERYLLIUM OXIDE

. . . shapes are available

Hot pressed and machined beryllium oxide shapes, for the nuclear, aircraft, missile, and electronics industries, are now being produced by the BERYLLIUM CORP. Blocks up to 12" in diameter and 6" in height are available. They can be machined, with extremely close tolerances, into building blocks for precisely designed assemblies.

Circle No. 217 on Reader Service Card

INSPECTION EQUIPMENT

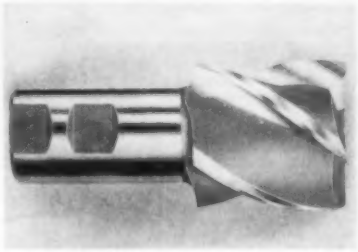
. . . is non-destructive type

Multi-frequency, non-destructive, high speed inspection equipment for non-ferrous and non-magnetic metals is available from the MAGNETIC ANALYSIS CORP. The equipment is based on an advanced and highly versatile eddy current inspection system. Uses include production line or independent testing of tubing, bars and wire for surface and sub-surface defects, grade, dimensions, etc.

Circle No. 218 on Reader Service Card

MILLING CUTTERS

. . . for die sinking

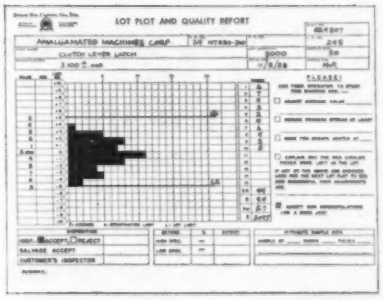


The "E" line of milling cutters has been introduced by the CUTTING TOOL DIV., TOMKINS-JOHNSON CO. The cutters have a high helix angle, double back-off, and a right hand spiral. These features are said to give the user more cuts between grinds.

Circle No. 219 on Reader Service Card

STROH INTRODUCES STATISTICAL QUALITY CONTROL FOR DIE CASTINGS

DIMENSIONAL CONTROL AT STROH DIE CASTING BEGINS WITH A CHART LIKE THIS . . .



Here's what the new concept of Quality Control at Stroh Die Casting means to you

CRITICAL DIMENSIONS can be held within specified limits. Buyers who rely on statistical dimensioning to assure accurate parts for assembly are invited to consult Stroh.

LOWER INSPECTION COSTS come from simpler receiving inspection instead of full sampling of each shipment of die castings. Many manufacturers now benefit from Stroh's Quality Control.

Write for Details

IN OUR 56th YEAR

Stroh Die Casting Co., Inc.

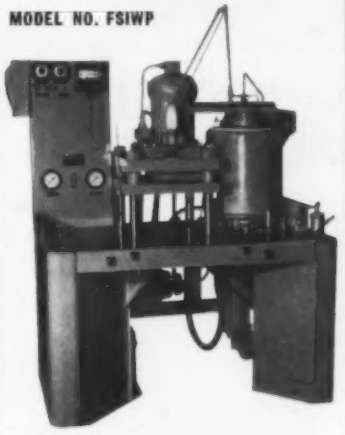
11123 WEST BURLEIGH STREET
MILWAUKEE 10, WISCONSIN

For more information circle No. 54 on the Reader Service Card

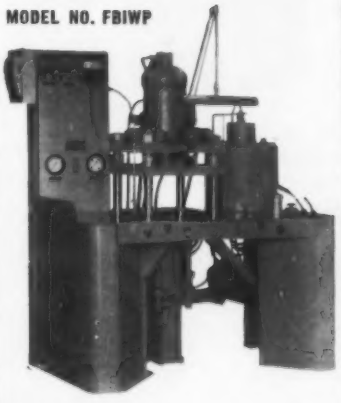
LEYDEN WAX INJECTORS

3 OF OUR MOST POPULAR MODELS

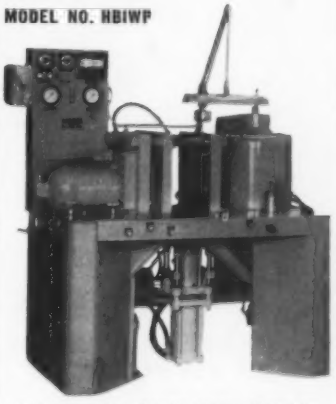
MODEL NO. FSIWP



MODEL NO. FBIWP



MODEL NO. HBIWP



For complete details write direct to Leyden Hydraulics

Any Type or Size Unit Built to Your Specifications.

LEYDEN HYDRAULICS, INC.

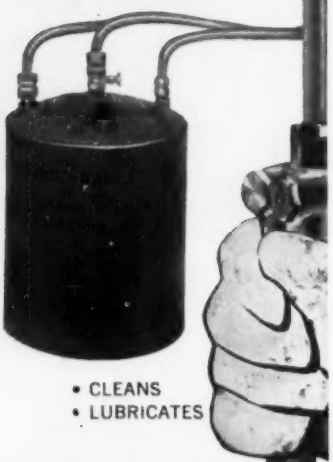
1800 North River Rd. · Melrose Park, Ill.

THE PIERCE-WALLER

AIR-LUBE

SYSTEM

CUTS COSTS for DIE-CASTERS



• CLEANS
• LUBRICATES

Remove loose flash and clean the mold with a powerful, clean air blast — then lubricate all mold surfaces evenly, *using the same gun* —with a flick of the thumb! Adjustment *at the gun* for full range from zero to a heavy mist, spraying, fogging, or vaporizing the lubricant. Speeds up mold operation and reduces casting rejects. Makes every machine cycle count.

USED IN LARGE AND SMALL SHOPS EVERYWHERE!

WRITE FOR *FREE* FOLDER

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P.O. Box 2121A • DAYTON 29, OHIO

***Plant:* RAJAK MFG. CO.**
Specialists in polyester impregnation of metals
245 N. Fourth St. • Tipp City, Ohio

Circle No. 47 on the Reader Service Card

For more information circle No. 40 on the Reader Service Card

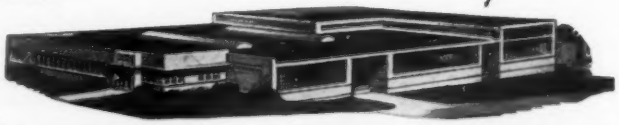
Get the results you want from DIE CASTING...

When you decide to use die cast parts, you expect, definite *results* in terms of *benefits* reflected in your manufacturing operations, or in your finished products. Milwaukee engineers and technicians, backed by the complete facilities of the modern Milwaukee plant, are qualified by training and experience to give you the results you are looking for . . . and more!

When you send your prints and "specs" to Milwaukee, you often get more than a quotation. You may get suggestions and proposals, when deemed useful, that will give you all the results you are looking for plus the *extra benefits* which the die casting process can give you.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

A partial list of RESULTS you can expect when you specify MILWAUKEE DIE CASTINGS
★ Less Machining
★ Improved Design
★ Closer Tolerances
★ Smoother Finish— at lower cost
★ Stronger Sales Appeal
★ Faster Assembly



MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

Remet Powdered Metal Part cuts DESIGN and MACHINING costs for Bonney Forge and Tool Works

R. L. Huston, Chief Engineer for Bonney, says, "We went to a powdered metal part on our shifter because the cost of machining this part from steel would have been prohibitive. Also, we would have had to change the entire design of our ratchet. We contacted no less than a dozen fabricators of powdered metal. Reese Metal Products Corp. was the only establishment able or interested in tackling this problem with us."

Bonney now uses Remet shifters in seven of their ratchets. The sintered Remet parts are copper infiltrated iron.

More and more design and production men each year rely on Remet services to help solve problems.

***FREE BROCHURE** "How to Cut Precision Parts Cost with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.*

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REESE METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets
"Oilless" Bearings • Bushings • Machine and Structural Parts in
COPPER • BRASS • IRON • ALLOY STEEL • NICKEL SILVER • COPPER INFILTRATED IRON

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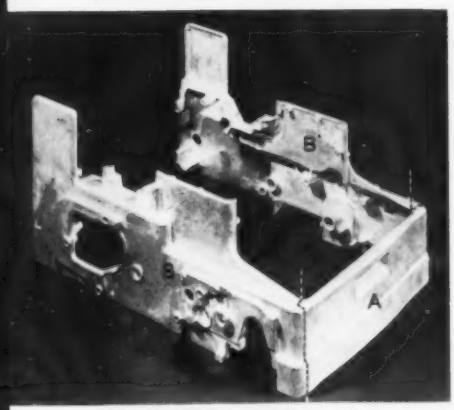

AN EXPENSIVE PROFILE milling operation was formerly required to match the sand castings. The dotted lines show the close match between the die cast front plate, (A), and the side plates (B).

HOW TO USE DIE CASTINGS

Diecast complex parts . . .

Don't Machine Away Profits

DO you think you could take two areas, 7.50 inches high by 18.75 inches long, and put in 51 projections, 28 recesses and 17 holes? The folks at Friden, Inc., thought it couldn't be done, at a reasonable cost.

Sure, they were doing it for the side plates of their machines, by machining the necessary holes, recesses and projections out of a sand casting. But it was very expensive.

At this point, engineers from Ainsworth-Precision Castings, Inc. analyzed the problem and said that the plates could be die cast, with all of the holes, recesses and projections, at a big savings. And, they did it.

Die casting the parts isn't easy. In all, there are three die cast side plates for each machine. The front plate is simple. It's the two side plates, which contain the projections, holes and recesses, that are extremely complex and difficult to cast. They have to be held to a length-wise straightness that has a .015 inch tolerance. This is then reduced to .005 inches by Friden.

All of the difficult and costly machining had been eliminated by the switch from sand to die casting. But, the only way to do the remaining machining operations, was on pre-set machines. These receive a particular piece and perform a specific operation. This calls for the die caster to hold extremely close tolerances to assure continuous production in the shop.

Another benefit, discovered by Friden, was that die castings are free from surface defects. This cut down surface preparation time for painting and added to their savings.

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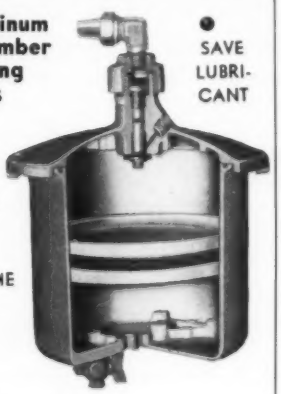

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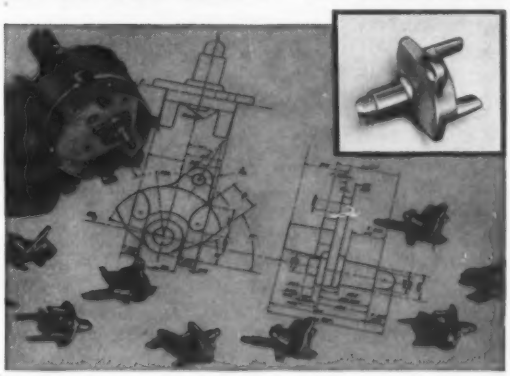
die cast for MALLORY by GRC

helped create higher rated, longer lasting switch



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"Impossible", yes, by any other method. BUT—GRC's unique single cavity die casting techniques made possible a detailed and complex actuating mechanism with exceptional requirements of uniformity and accuracy. Inspired Mallory engineers to design a new and better switch around this GRC die cast mechanism! Just another instance in which GRC's exclusive patented methods have solved a parts problem and opened the door to a new product . . . at substantial savings.

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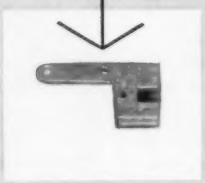
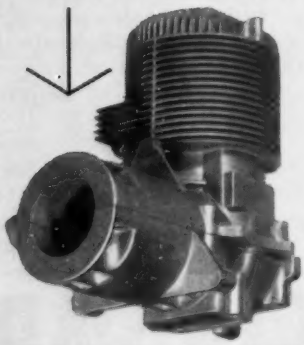


TO
engine cylinders



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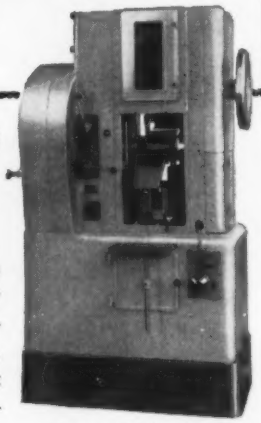
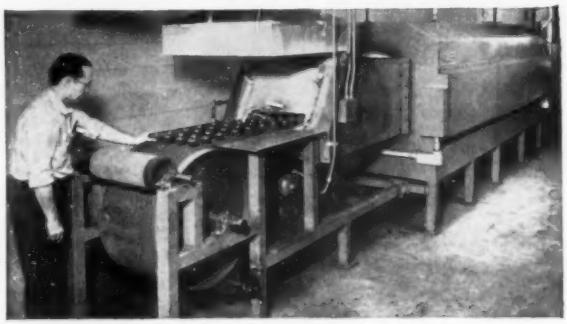


Model 2000 (18 ton Cap.)



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Illustrated is the standard 1" gage length tensile bar with 1" depth of fill.

Some 25 different shapes available. Designed to withstand pressures up to 100 t.s.i.

Variety of special shapes with interchangeability for maximum versatility.

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PMM METALS TECHNOLOGY

INCREASED COLUMBIUM PRODUCTION

Both columbium and tantalum are becoming more and more important in our present economy. Evidence of this is found in the increased production and the increased imports of ore concentrates.

Domestic production of columbium metal is said to have tripled in 1958 with a moderate increase in the production of tantalum. Both National Research Corp. and U. S. Industrial Chemicals, Inc. started pilot plant production of these metals last year. Stauffer Chemical Co. is constructing a plant for the production of both metal chlorides. The new plant is expected to go into production in 1959. Temescal, Inc. is in production of ultra-high purity columbium metal using electron beam melting.

The increased interest, particularly in columbium, has come about through the need for metals which will have useful strengths at high temperatures. There are indications that both of these metals may have applications in the 4000°F range.

Many metals research men are convinced that columbium may have properties still not known and they believe that many new and important columbium bearing alloys will be developed in the next few years.

The anticipated uses seem to be for around 50 tons per year of very high purity metal for nuclear uses and some 500 tons per year for aircraft and missles. This latter will not require such high purity metal as is needed for nuclear work.

NEW ALUMINUM CASTING ALLOY

The Aluminum Co. of America has developed a new casting alloy designated as X250-T4. The alloy is designed to have high strength and good ductility.

Anticipated applications for the new alloy are in aircraft structural castings, construction or mechanical equipment subject to impact and in equipment for the dairy, food and chemical industries. The alloy has excellent resistance to both industrial and marine atmospheres.

High resistance to stress corrosion and retention of good ductility during natural aging are other advantages. No special quenching techniques are needed to secure high tensile strength.

The new alloy is expected to replace alloy 220-T4. It is initially offered with the same minimum tensile strength as alloy 220.

HIGH TEMPERATURE FERROUS-BASE ALLOY

A new iron, aluminum, manganese alloy family with desirable high temperature strength, oxidation resistance, workbility and light weight has been developed by National Research Corp.

Indications are that the new alloys may have considerable promise for high temperature uses in missiles, aircraft.

Some of the reasons for optimism are:

1. Little loss of strength above 1200°F.
2. Light weight, about 15% less than carbon or stainless steel and 20% less than the cobalt base alloys.
3. No loss in strength if heated after cold working. Aging after cold work increases the hardness. Extrapolated tensile strengths indicate an ultimate of about 250,000 psi.
4. Good oxidation resistance at 1500°F.
5. Good cold working properties, about the same as 18-8. Normal equipment for working stainless steel can be used.
6. Machinability is about the same as for 304 stainless.

The most promising alloy has a composition of: 10% aluminum, 34.4% manganese, 0.76% carbon, balance iron.

shotgun shot

BADLY FORMED AND MIXED IN SIZE, WOULDN'T WORK WELL IN GUNNING.

ALUMINUM SHOT

BADLY FORMED AND MIXED IN SIZE, WOULDN'T DO THE JOB IN ALUMINUM ADDDITIONS TO ZINC.

GENERAL'S ALLOYING SHOT

is produced to assure round, solid uniformity with no "pop-corn". Firm and equal sized, General's **bright and shiny** shot goes rapidly into solution . . . avoids wasteful skim.

GENERAL'S ALLOYING SHOT also available, custom made to exacting specifications.

Details on request.

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Phone: GArfield 3-3200

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PMM OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding. 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITIONS OPEN

DIE CASTING ENGINEER — The Western Electric Company, Manufacturing and Supply unit of the Bell Telephone System, has an immediate opening for graduate engineer experienced in aluminum die casting methods, die design and production operations. Engineering background and "knowledge" are required. This is an excellent opportunity in a progressive company. A personal interview at the factory (expenses paid) will be arranged for a qualified candidate. Liberal relocation allowance will be granted, if employed. For a prompt reply, write to Western Electric Company, Employment Manager, 2500 Broening Highway, Baltimore 24, Maryland, giving age and a brief outline of education and experience.

Sales representative for old established manufacturing company expecting to produce Custom Powder Metal Parts within one month. Interview to be arranged after receipt of resume sent to Kruse & Slattery, Inc., 1492 Haddon Ave., Camden, N. J.

EQUIPMENT

Used Investment Casting Equipment
High production wax injectors of superior design. 12 lb. arc melting furnaces. Chicago Pneumatic knockout. Equipment well maintained. Priced right. Write: Hulver and Merrill Sales Representatives, 5837 Swope Pkwy., Kansas City 30, Mo.

LINDBERG WILL SELL UPTON SALT BATHS

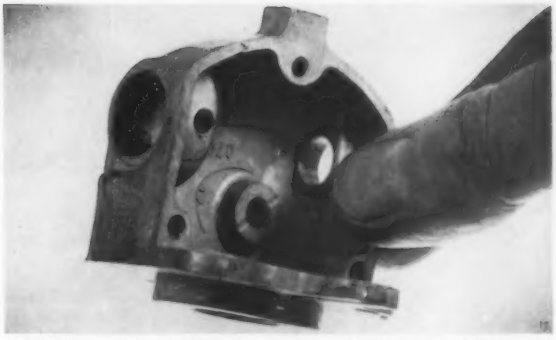
Under an exclusive sales agreement between Upton Electric Furnace Co. and LINDBERG ENGINEERING CO., the national sales of salt bath heat-treating furnaces will be handled by Lindberg.

The Upton line includes both high and low temperature salt baths for production work, pilot plants and laboratories.

HOW TO USE | **DIE CASTINGS**

No machining needed!

Casting To ± .0005 Lowers Part Cost



CASTING THE HOLES for the motor shaft, worm shaft, and the oscillating drive shaft to required accuracy, was the big problem on this part.

TRUE or FALSE?

• Specify ± .0005, and your part costs zoom upwards.

• Extremely demanding dimensional tolerances usually mean secondary machining operations.

ANSWERS: False.

REASON: The gear case, illustrated, for a 16" oscillating fan, manufactured by Emerson Electric Co., is die cast in zinc with specified tolerances that are held to ± .0005 inch.

Here's the Story: Motion from the fan motor is transmitted to the fan blades through a gear mechanism that consists of two worm gears and a spur gear. This imposes an extremely close dimensional tolerance requirement: To achieve optimum alignment and avoid reduced drive efficiency, the holes in the gear box for the motor shaft, worm shaft and the oscillating drive shaft, must be held to ± .0005 inch.

This unusually close tolerance, including draft, is die cast in zinc by the St. Louis Die Casting Corp. Casting this dimension into the case has eliminated the need for secondary machining operations, cutting production costs to a minimum. Production steps are: cast and trim.

The part is difficult to cast because the cores must be pulled in three directions at right angles to one another. 30,000 of these gear cases are cast per year in a 2-cavity die at a production rate of 230 parts per hour.

Die Inserts for Zinc or Aluminum Are ACCU-CAST®

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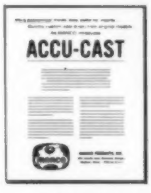
By Shaw Process

ACCU-CAST* components for die-casting are produced in Nu-Die V, VDC, or other hot-work steels to close tolerances.

Casting from original patterns eliminates need for master hobs and prolonged machine cutting of cavities and cores . . . provides cost savings, greater design leeway, fidelity of detail, and excellent surface finish.

Manco's UQC (Uniform Quality Control) and long experience assure sound, trouble-free components for exacting requirements.



FREE: copy of ACCU-CAST technical bulletin. Write, wire, or phone:

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For blind holes, tapping in steel, copper, etc. wherever there is danger of breaking taps.

QUICK-CHANGE
Tool-Holders to Drill, Tap and Set Studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder, if required.

POSITIVE
For through holes where work is drilled and then re-handled and tapped.

BALL BEARING CONE-DRIVE
Designed for Ball Bearing High Speed Drill Press.

These Tappers may also be adapted for button or acorn die threading.

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Main Office and Plant: STATEN ISLAND 4, NEW YORK

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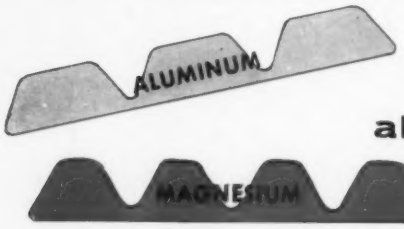
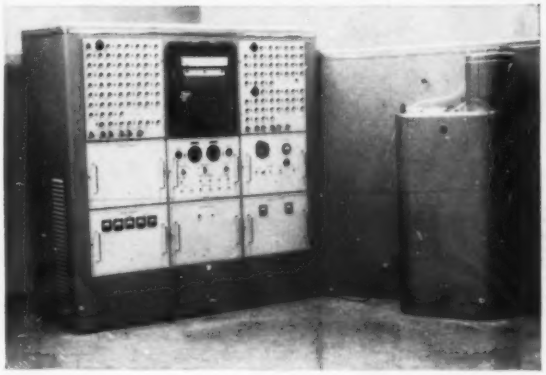


How APEX Production Control produces alloys tailored to your specifications with certified accuracy

Your specification page in the Apex Spec Book controls your ingot production—holding alloy elements to desired content for castability and maximum properties.

Once recorded, your particular specs become the formula for your alloy production in all Apex plants. Under meticulous control, you receive an alloy to meet casting applications requiring special mechanical properties, physical properties, machinability, corrosion resistance or other individual needs. The Spec Book also includes specifications for all standard alloys conforming to governmental and society specifications.



The QUANTOMETER assures you of an alloy conforming to your specifications

Our sales engineers will gladly discuss the Apex production control system as it applies to your casting requirements. Call on us now for composition accuracy and prompt shipment of your alloys.

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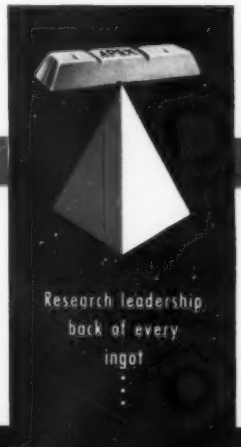

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